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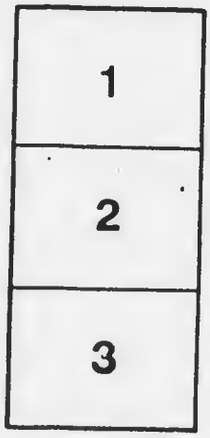

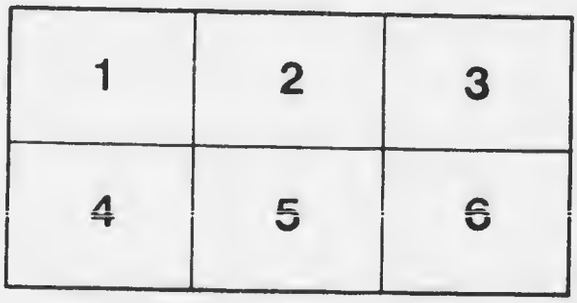

LIBRARY PLANNING
BOOKSTACKS and
SHELVING

BERNARD RICHARDSON GREEN, the inventor of the Library of Congress bookstack, was born December 28, 1843 at Malden, Massachusetts and died October 22, 1914 at Washington, D. C. He was graduated from the Lawrence Scientific School of Harvard University, in 1863, with the degree of S.B. in Civil Engineering. The subsequent thirteen years were spent with United States Engineer officers, constructing permanent fortifications in Maine, New Hampshire and Massachusetts. From that time until his death Mr. Green was in charge of the erection of large public buildings, among which are the State, War and Navy Building, Army Medical Museum and Library, United States Soldiers' Home Buildings, Washington Monument, Library of Congress, Washington Public Library and the National Museum. During the last sixteen years of his life, in connection with his other work, Mr. Green was in charge of the Library of Congress as Superintendent of Building and Grounds.

LIBRARY PLANNING BOOKSTACKS *and* SHELVING

WITH CONTRIBUTIONS FROM THE ARCHITECTS' AND LIBRARIANS' POINTS OF VIEW

Illustrated

SNEAD & COMPANY IRON WORKS, LTD.
TORONTO, ONTARIO JERSEY CITY, N. J.

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FOREWORD

THIS BOOK is published for distribution among Architects, Librarians and Trustees, to give general information regarding the planning of library buildings, specific facts in connection with the problems of book storage, and details of the construction of Snead Bookstacks, Shelving and other products.

The Snead & Company Iron Works began the manufacture of metal bookstacks when they first came into use and have built the largest stacks in America, including those of the Library of Congress, Ontario Legislative Library, New York Public Library and Widener Memorial Library of Harvard University. We have also equipped many libraries in foreign countries. As this is a highly specialized work, the experience gained in both large and small installations is one of the Company's most valuable assets.

The manufacture of metal bookstacks is a development of the architectural and ornamental iron and bronze business established in 1849 at Louisville, Kentucky, by Charles S. Snead, one of the pioneer iron founders of the United States. The Louisville plant was destroyed by fire in 1898 and was subsequently re-established in Jersey City, N. J., where the main office and works are now located. The business is owned entirely by the officers actively engaged in its management.

Architects, trustees and librarians planning to install bookstacks, either in new buildings or old, may call upon Snead & Company for layouts, estimates and advice, which will be given either by correspondence or by the personal call of an expert. All that is asked in return is an opportunity to submit a proposal and to demonstrate that it is to the owners, best interest to use the Snead product.

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SNEAD STANDARD STACK, TECHNOLOGY ROOM, NEW YORK PUBLIC LIBRARY

Photograph taken before the installation of the adjustable shelves.

THE MODERN BOOKSTACK

PRINCIPLES AND DEVELOPMENT

THE prototype of the modern bookstack was designed in 1876 by Professor William R. Ware, of Ware & Van Brunt, and Mr. Justin Winsor, acting together as architect and librarian for the extension of Gore Hall, the Library of Harvard College. A shell was built of masonry walls pierced by rows of small windows and carrying a roof supported by trusses. Into this were packed book ranges, row on row, tier on tier, with only enough vacant space to give access to the books. The aisles between the ranges were 28 inches wide and the tiers 7 feet high, allowing the topmost of the seven rows of shelves to be easily reached. The stack was six tiers high, self supporting throughout and depended on the building for protection only. The vertical shelf supports were of cast iron open work, the deck framing of rolled wrought iron, the deck flooring of perforated cast iron slabs and the shelves of wood, supported at the ends by light zinc Z bars fitting into notches in the uprights. This Gore Hall stack was a distinct advance in compact permanent shelving and in it were laid the basic principles of stack construction; it was copied for a number of libraries, including the Boston Athenæum, the Surgeon General's at Washington, Amherst College and the University of Michigan.

No further advance of any importance was made in stack construction until the building for the Library of Congress at Washington was taken in hand in 1889 and the necessity arose of providing shelving for millions of volumes. A system of storage on a large, complete, thoroughly economical scale had not as yet been devised. The wood, or wood and iron combinations which had hitherto been constructed were crude, bulky and inflammable, dusty, close, overheated at the top, inconvenient of access, poorly lighted and unadaptable. Librarians were dissatisfied and the theory of shelving on the stack principle had gradually fallen into disrepute. Tall single tiers reached by ladders, or a few tiers arranged in alcoves were attempted, but found inadvisable because of the extended area of administration, the greater size required for buildings and grounds and the resultant increase in cost of construction and maintenance. Consequently the problem presented by the Library of Congress was new in almost all its elements. The United States War Department assigned the construction of the Library to a prominent civil engineer, Mr. Bernard R. Green. After an exhaustive consideration of the needs of libraries and of new materials and manufacturing resources available, Mr. Green prepared a full sized working model of a bookstack, accom-

Fig. ORIGINAL GORE HALL BOOKSTACK
HARVARD UNIVERSITY

The prototype of the modern bookstack

The stack illustrated was not supplied by The Snead & Co. Iron Works.

panied by drawings and specifications. He then advertised for bids for the construction of three nine-tier stacks containing 43 miles of shelving with a capacity of 2,000,000 volumes. The leading architectural iron manufacturers of the country entered the competition and the contract was awarded to the lowest bidder, The Snead & Co. Iron Works, then of Louisville, Ky. Mr. Green's invention was a success and has served as a model for all subsequent stacks. This is due to its extreme simplicity and convenience, the attainment of a minimum of space occupied by the materials used and a maximum of space available for books at a cost reduced to the lowest terms. The Library of Congress stacks have been in use for about twenty years; no part of the great combination has given trouble or needed repair and the whole is as perfect and serviceable as when installed.

REQUISITES FOR PROPER BOOK STORAGE

A thorough study of the fundamental requirements which govern the successful storage of books in a large, growing library has resulted in the establishment of the following rules. There should be:

Accommodation for books of every variety, shape and binding.
Direct and immediate access to every volume with a minimum distance to travel.
Location in close communication with cataloging, reading and delivery rooms.
Thorough illumination, either natural or artificial, by day and night.
A constant supply of fresh air and an evenly regulated temperature, in order to prevent the deterioration of both paper and bindings.
The greatest possible freedom from dust.
Facilities for proper classification, arrangement and rearrangement.
Maximum development of book space and provision for indefinite expansion

BOOKSTACK PRINCIPLES

The modern bookstack, as designed first by Mr. Green for the Library of Congress, grew out of the scientific application of these requirements, and has proved itself to be the most convenient, compact and economical method of storing books. Through its success certain general principles of bookstack construction have come to be advocated:

1. Books are most advantageously shelved in tiers of double-faced parallel ranges, with

single-faced ranges along end walls; radial ranges waste space and are costly. A row of shelf compartments end to end constitute a range. A number of ranges side by side form a tier. A series of superimposed tiers or an isolated tier forms a bookstack.

2. The height of each tier should be 7 feet or 7 feet 6 inches, preferably the former, as every shelf is then accessible to a person of average height.

Fig. 2. Section through bookstack and deck flooring showing vertical, protected deck slit

3. Between each two tiers there should be a thin deck floor made of solid material, preferably white marble or, as a second choice, glass. Along the face of each range and around the walls should be an open space or deck slit 2 or 3 inches wide for ventilation, light and the safety of the lower rows of books from injury by moving trucks or feet. Deck slits are protected by curbs about 1 inch high to prevent litter or articles being pushed off. By extending the bottom fixed shelf over the deck slit the opening is further protected and accommodation is provided for extra large books. See Fig. 2, also Fig. 106, page 69.

4. The stack tiers should be uniform in size and superimposed on each other in order to secure convenience, interchangeability, greatest economy of space, best lighting and the least expensive construction.

5. Main corridors should connect the aisles between the ranges of each tier and the tiers should be connected vertically by means of stairs and lifts. Speaking tubes, telephones, telautographs, pneumatic tubes and automatic book conveyors may also be used for communication and transportation.

6. The materials of stack construction should be non-combustible throughout. The vertical shelf supports should be strong enough to carry not only the load of books, but also the superimposed tiers, deck floors and any overhead loads, in order to eliminate the use of large structural columns within the stack room.

7. All parts should be simple and solid, with no inaccessible pockets to harbor dust or book pests. The construction should be as open as possible for lighting, ventilation, cheerfulness and supervision.

Fig. 3. READING AND STACK ROOM, CINCINNATI, O., PUBLIC LIBRARY

Illustrating above arrangement.

The stacks illustrated were not supplied by The Snead & Co. Iron Works

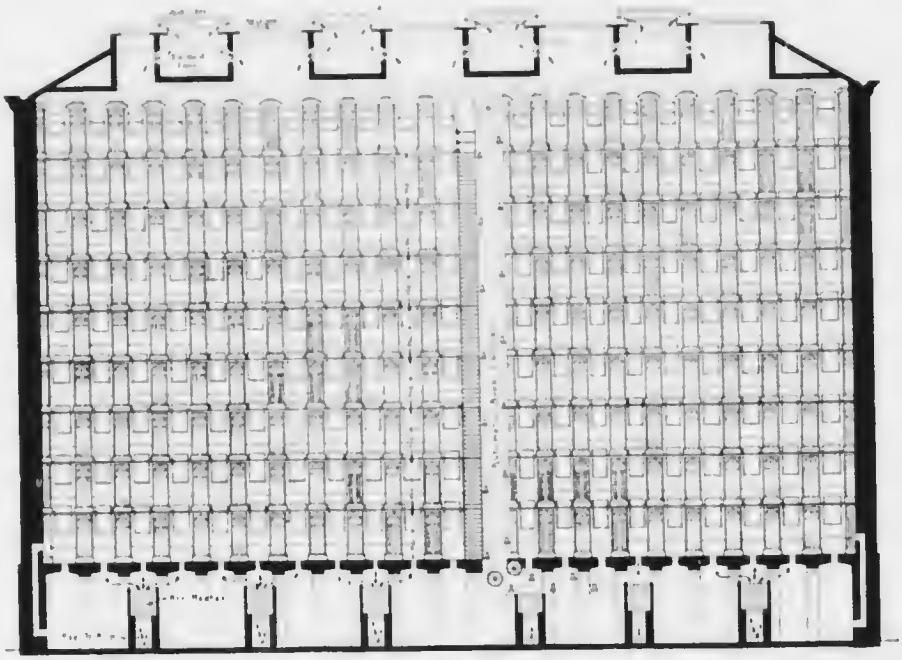


Fig. 4. LONGITUDINAL SECTION OF NORTH STACK, LIBRARY OF CONGRESS, WASHINGTON, D. C.

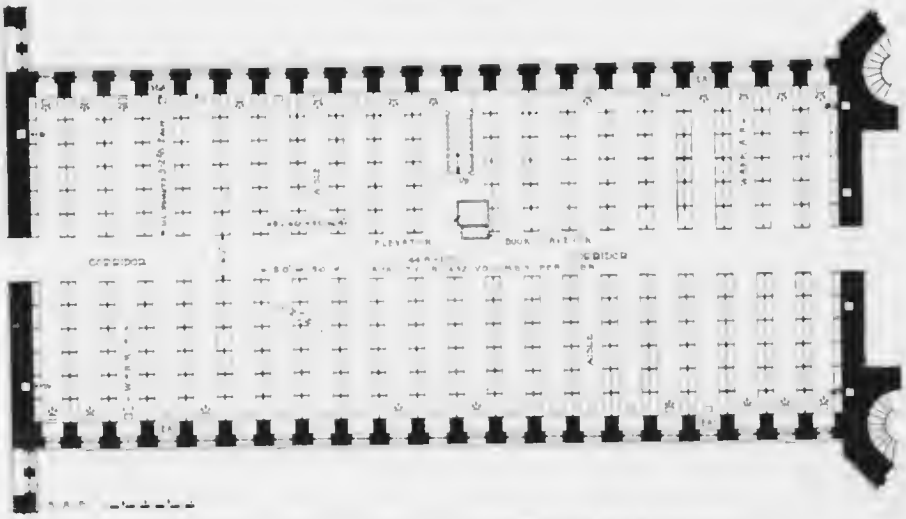


Fig. 5. PLAN OF NORTH STACK, LIBRARY OF CONGRESS, WASHINGTON, D. C.

8. Fixed stack members that become a permanent part of the building require a protective covering that can be renewed. They should be finished after erection with aluminum bronze, or some light reflecting enamel, preferably white or light grey. Adjustable shelves are most economically and satisfactorily finished with baked enamel.

9. Shelf supports should be of open work design, thin, flat and rigid, with stiffening ribs extending between the shelves in order not to occupy valuable book space and to make the stack as nearly as possible a *stack of books.*

Fig. 6. Section through stack front

Fig. 7. Section through partition

10. Shelves should be easily adjusted, but firm and immovable when in place, interchangeable, thin for compactness, easily stowed away when not in use, and of open bar construction for cleanliness, strength, lightness and ventilation. They should neither require tools for adjustment nor have end brackets or loose parts. A smooth surface, permanently protected from corrosion and free from sharp points or raw edges, is required. Shelves are usually 8 inches or 10 inches wide and about 3 feet long.

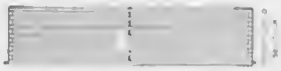


Fig. 9. Plan and section of Open Bar shelf

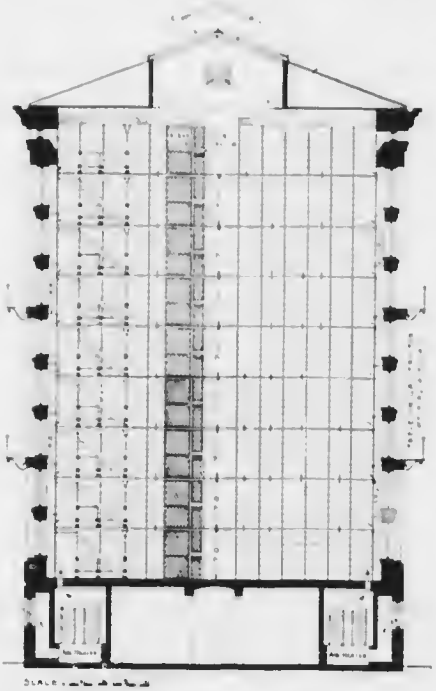


Fig. 8. TRANSVERSE SECTION OF NORTH STACK LIBRARY OF CONGRESS, WASHINGTON, D. C.

11. Hermetically sealed windows in large stacks are effective in making mechanical ventilation thorough and excluding dust. With such windows, automatically closing doors and a filtered air supply, the only dust which need be contended with is that which comes from the handling of the books.

12. Skylights will only illuminate one or two top tiers. In high stacks there must be ample side light if daylight is to be depended upon. Windows should be as tall as possible and placed opposite the range aisles. However, daylight is irregular and its use often uneconomical and unnecessary with proper electric light equipment.

13. The parts of the stack construction should be few, simple and proof against wear and tear. There should be effective fire stops formed of solid steel plates between the shelves of each two tiers to prevent the spread of fire in the books. Flanged cover plates over the top ranges are advisable for keeping off dirt and preventing damage from a leaky roof or ceiling.

14. Tables and ledges for work within the stack are often required, also book supports, number plates, back stops, card frames and shelf label holders.

Fig. 10 BRACKET STACK CONSTRUCTION

Stack installation equipped with The Snead & Co. Iron Works

OTHER STACK DESIGNS

The system of shelving designed for the Library of Congress embodies all these general principles. Designs have been made by others based on the Library of Congress construction, but in order to cheapen the product and gain the market, certain essential features have been altered and the results have not proved successful. Thin sheet steel bent in a hollow form has been substituted for the solid cast iron shelf supports of the Green-Snead stack, but at the expense of compactness, strength, sanitary design and openness of construction. Adjustable shelves have been made of plain sheets of steel as a substitute for Open Bar shelves, but their hindrance to ventilation, inconvenience in handling and use of accessories and dust collecting tendencies have prevented their meeting with approval in spite of reduced cost. Also the baked enamel finish, permissible for the shelves, has been applied to the fixed parts of the construction, entailing the loss of adaptability for renewal and repair, so necessary in a permanent structure. For some time the bracket type of stack with narrow post uprights and projecting shelves was popular because of its novelty and cheapness. Continual use, however, emphasized its inconvenience, ugliness, instability and lack of true economy, so that it is now rarely considered in competition with the Library of Congress standard type.

Fig. 1 Section through sheet steel adjustable shelf support

After twenty years of use the Snead Standard Stack still holds its own, unique in three vital features which will be taken up in detail in the following pages:

Form of shelf supports.
Construction of the shelves.
Method of finishing the metal.

Fig. 12. BIBLIOTHÈQUE ST-SULPICE, MONTREAL, QUEBEC

Unfinished stack skeleton without marble deck flooring or adjustable shelves.

SHELF SUPPORTS

THERE are two kinds of shelf supports: those at the ends, called Range Fronts and the intermediate ones, called Partitions. Each of these is divided into two classes: double-faced, for ranges accessible from both sides, and single-faced, for ranges accessible from one side only. That side of a range front which serves to hold the shelves is similar to a partition; the other side is designed to give a finished appearance.

Simplicity and compactness are gained by making the vertical shelf supports serve several purposes: to support the adjustable shelves, to hold the books upright, to carry the deck floor of the tier above and to carry the shelf supports of the superimposed tiers.

The shelf supports have rows of rounded blunt teeth on their front edges and horn locks, formed from No. 16 strip steel, riveted to their central stiffening ribs to automatically lock the shelves in place and allow of their easy adjustment at intervals of about 1 inch.

There are stock patterns for making four regular designs of range fronts, each of several widths and heights, all illustrated in figures on pages 22 and 23. Special designs to conform to any architectural requirements will be made if warranted by the size of the order.

Cast iron was the shelf support material selected by Prof. Ware for the first stack in Gore Hall, Harvard University, and it was later used in an improved form for the Library of Congress, the New York Public Library and the Widener Library of Harvard, besides many of the other most important libraries in the country. Cast iron has several unique advantages for bookstack shelf supports. From one pattern, by mechanically operated moulding machines, an almost limitless number of identical shelf supports can be made, each having the same adjustment teeth, stiffening ribs, rounded edges and corners, perforations for the distribution of light and air, and the same mouldings and panels for architectural design. This wholesale duplication cannot be done except by casting.

Cast iron is more resistant to fire or rust than wrought iron or steel,* and has an excellent surface for holding an enamel finish. The shelf supports are simple. Each one extends the width of a range and the height of a tier, and as a rule consists of a single casting. They are solid with no inaccessible dirt pockets, and are compact in form, fitting between the

**Extract from Kidder's Architects and Builders Pocket Book*

(The most widely used work of reference in the Architectural offices of the country.)

Page 729. "Cast Iron. As the result of tests and actual experience in conflagrations it may be stated that unprotected cast iron can stand practically unharmed up to a temperature of 1300 or 1500 degrees F. while carrying very heavy loads, even with the frequent applications of cold water while the metal is at red heat." (Freitag)

"No building can be considered fireproof in which unprotected iron or steel columns are used; but in many classes of buildings unprotected cast iron columns might safely withstand any heat to which they would probably be exposed. From a fire resisting point of view cast iron columns are unquestionably preferable to steel columns when unprotected."

Extract from Skeleton Construction in Buildings
By William H. Birkmire

(A leading architectural engineering authority.)

Page 18. "Mild steel rusts faster than wrought iron at first, then slower. Cast iron on the contrary slowly oxidizes in damp situations, rust does not scale from it and oxidation when formed is of much less dangerous kind, extending only a little way into the metal to about the thickness of a knife blade, then stops for good. Cast iron of goodly thickness offers a far better resistance to fire or to fire and water combined than wrought iron or steel."

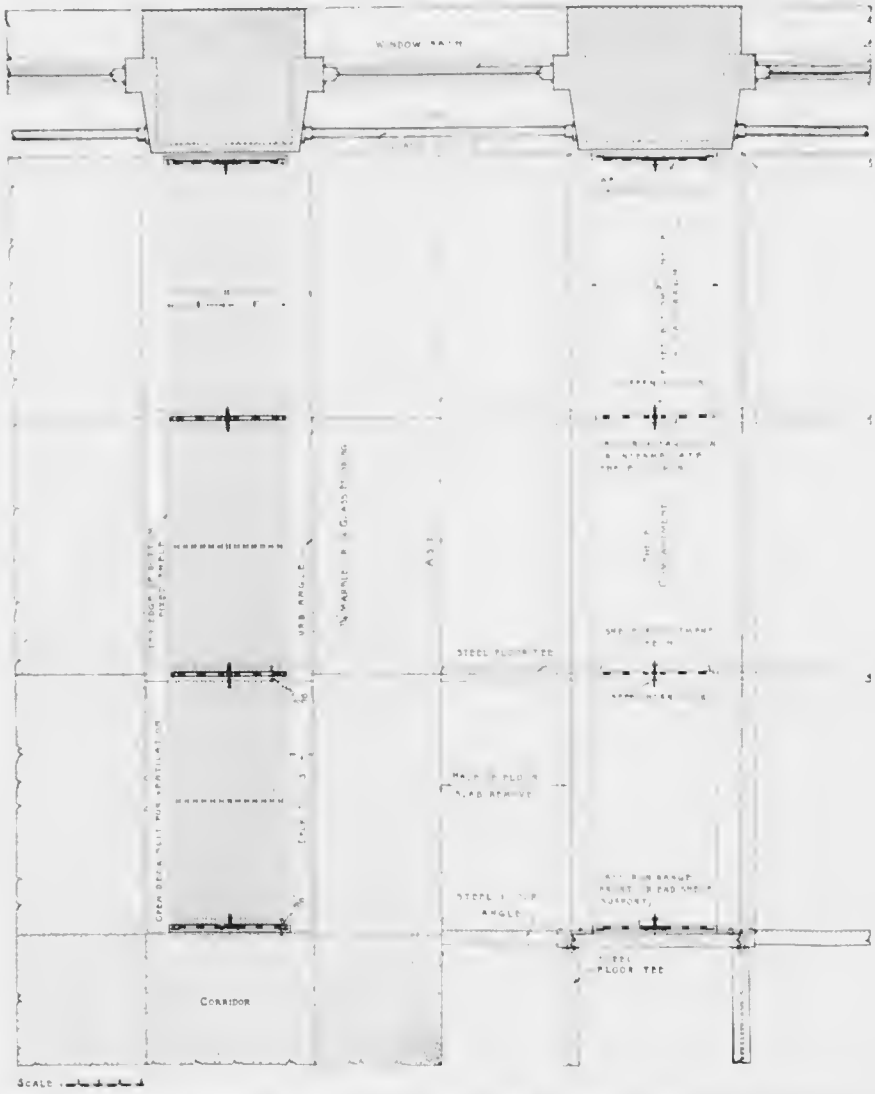


Fig. 13. SECTION THROUGH SNEAD STANDARD STACK SHOWING DECK FLOOR AND PLAN OF TYPICAL 16″ RANGES

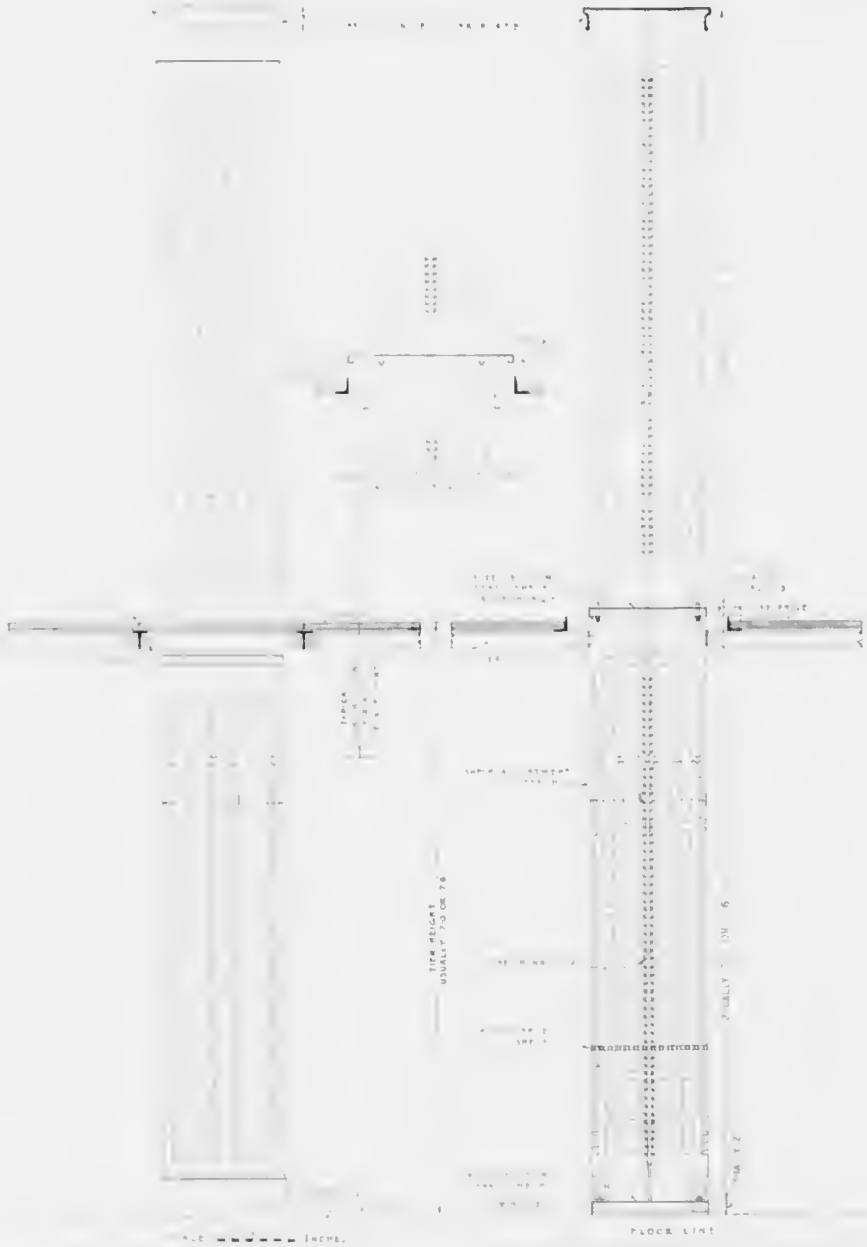


FIG. 11 SECTION THROUGH DECK FLOOR AND TYPICAL 16" RANGES OF SNEAD STANDARD STACK

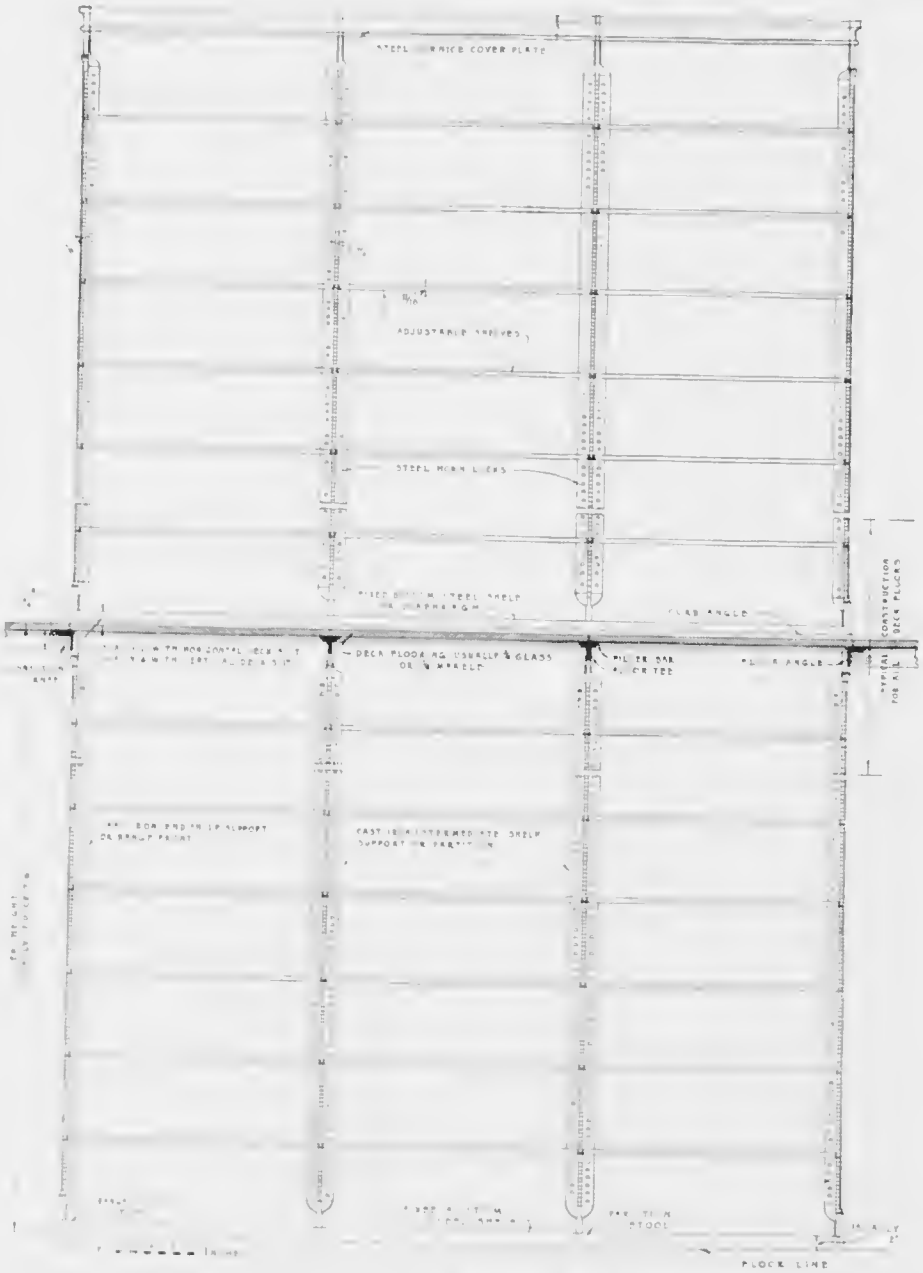
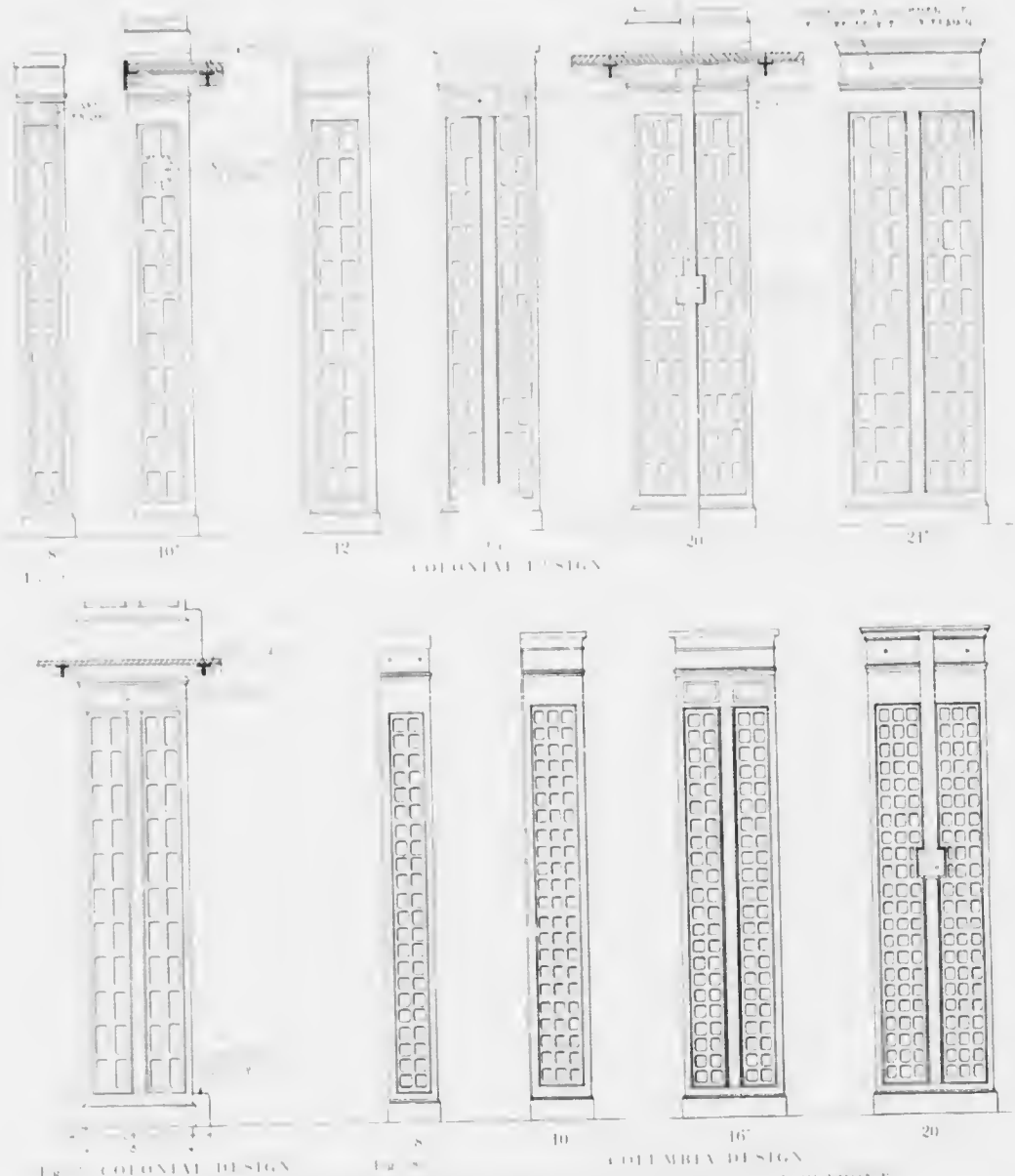


Fig. 15. SECTION THROUGH DECK FLOOR, SHOWING SIDE ELEVATION OF TYPICAL RANGES OF SNEAD STANDARD STACK



STOCK PATTERNS AND STANDARD SIZES OF SNEAD STANDARD STACK RANGE FRONTS

The various types of top finish, electrical arrangements and card frames shown are applicable to each of the different range fronts. The standard heights are 7' 0" and 7' 6". The widths of ranges are designated by the widths of the adjustable shelves contained therein if single faced, by the width of one shelf, if double faced, by the width of two shelves. The actual range widths are ½" to 2½" greater than these dimensions, as shown on page 20.

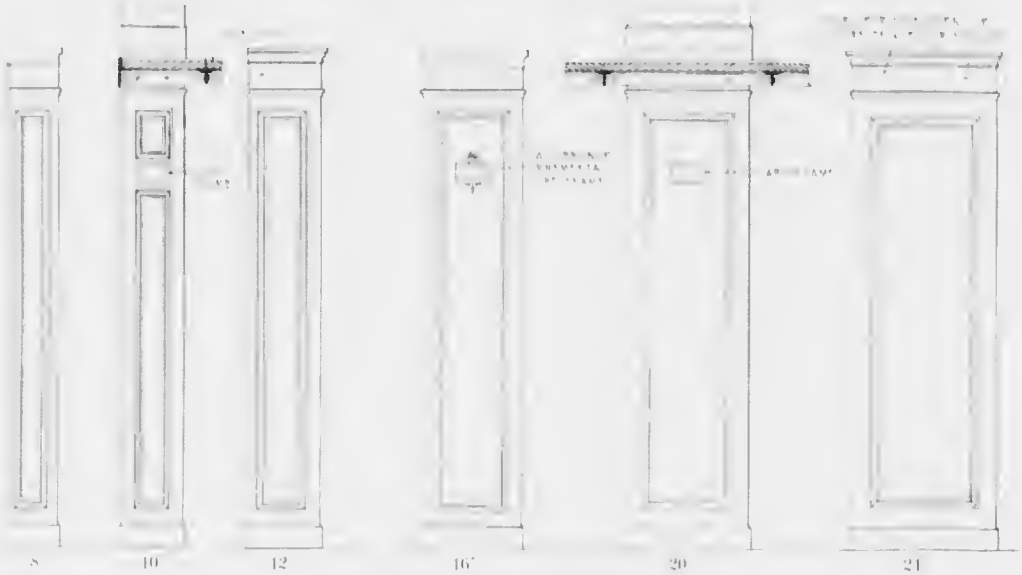


Fig. 19

SOLID PANELED DESIGN

Similar design with Gothic detail also furnished

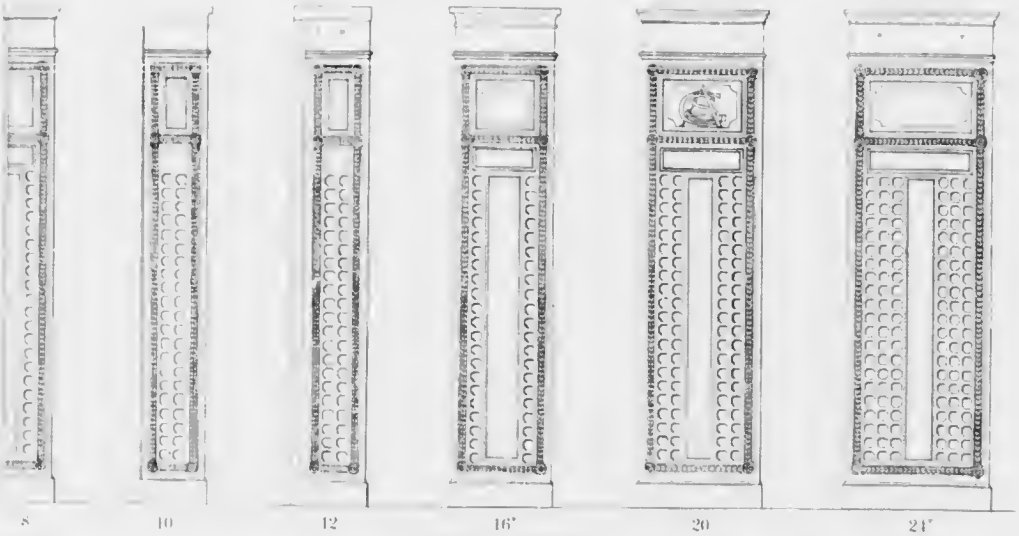


Fig. 20

CLASSIC DESIGN

STOCK PATTERNS AND STANDARD SIZES OF SNEAD STANDARD STACK RANGE FRONTS

The various types of top finish, electrical arrangements and card frames shown are applicable to each of the different range fronts. The standard heights are 7′ 0″ and 7′ 6″. The widths of ranges are designated by the nominal widths of the adjustable shelves contained therein: if single-faced, by the width of one shelf; if double-faced, by the width of two shelves. The actual range widths are ½″ to ¾″ greater than these dimensions — as shown on page 20.

Fig. 21 COLONIAL DESIGN RANGE FRONTS

Top tier of stack room, Delaware State Capitol, Dover, Del.

Fig. 22 COLUMBIA DESIGN RANGE FRONTS

View in top tier of stack room, Library of Hawaii, Honolulu, showing stack supporting floor of open air reading room above.

Fig. 23. SOLID PANELED DESIGN RANGE FRONTS

Seminar room, Lincoln Hall, University of Illinois, Urbana, Ill.

Fig. 24 CLASSIC DESIGN RANGE FRONTS

Stack room of the College of Physicians, Philadelphia, Pa.

Fig. 25. RANGE FRONT

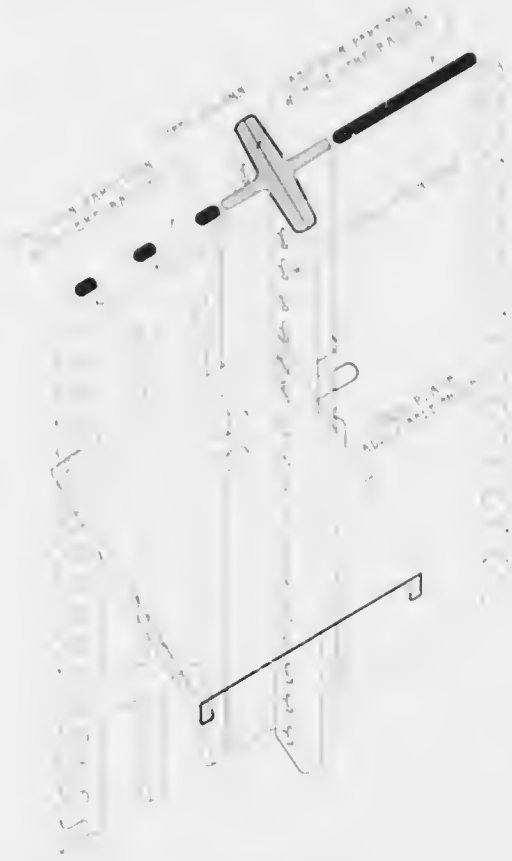


Fig. 26. PARTITION

Isometric views showing the construction of range front and partition with structural steel columns.

ends and backs of the shelves, with a loss of but $\frac{5}{16}$ inch of book space in each shelf length.

The iron used for shelf supports is mixed by chemical analysis to obtain the maximum strength and toughness. Each casting is carefully inspected and tested before it leaves the factory and typical samples of the various patterns are sent, from time to time, to the Arsenal at Watertown, Mass., to have their ultimate strength determined on the 800,000 lb. U. S. Government testing machine. By these precautions the stability of every stack is absolutely assured.

Occasionally manufacturing and engineering conditions arise which make it advisable to use a combination of cast iron and structural steel for the shelf supports. See Figs. 25 and 26. In such cases the shape and appearance are the same as when cast iron is used exclusively and no feature is affected which concerns either the architect or librarian.

SHELVES

UP to about twenty years ago book shelves were commonly made of flat wooden boards, but these met with disapproval on account of inadequate ventilation and the quantity of dust that collected upon them and ground the bottom edges of the books. Attempts were made toward an improved shelf of open work construction and some of the simpler of these showed a distinct advance towards scientific book storage. It became evident that the solution of the problem lay in that direction.

This is how matters stood when the contract was taken up for the adjustable shelves in the bookstacks erected by Snead & Co. in the Library of Congress. Specifications were drawn calling for bids on open work shelves to fit in the shelf supports already provided. Bids were submitted by manufacturers from all parts of the United States and about sixty samples were shown. The contract was awarded to Snead & Co. who submitted a shelf consisting of light ∩ shaped parallel bars. This shelf was pronounced the best, even by the other competitors, none of whom have ever since attempted to manufacture their own inventions.

The Snead Open Bar shelf is designed for convenience, lightness, strength, perfect adjustability and to give the books thorough ventilation. The bars are gently curved on top so that they will leave no impression on the books. They are made of bright polished strip steel with a surface as smooth as glass. Their form allows the use of several convenient stack accessories: rigid book supports and back stops, which lock between any two bars, also label holders which lock around the shelf bars and cannot be dragged off by books. The Open Bar shelf permits the circulation of air and has a certain flexibility which allows it to bear on the four points of support without rattling, no matter how heavily loaded, just as the springs of an automobile allow the load to rest partly on each of the four wheels. Dust cannot grind the bottoms of the books as it falls between the bars as soon as a book is moved. Dust is easily cleaned from the tops of books but cannot be cleaned from a solid shelf without first removing the books. Each shelf is complete in itself and there are no bolts, pins or other movable parts for which one has to search or feel.

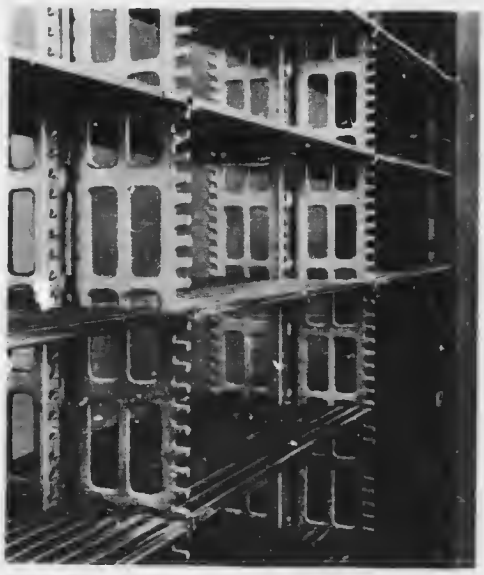


Fig. 27. SNEAD OPEN BAR SHELVES IN PLACE

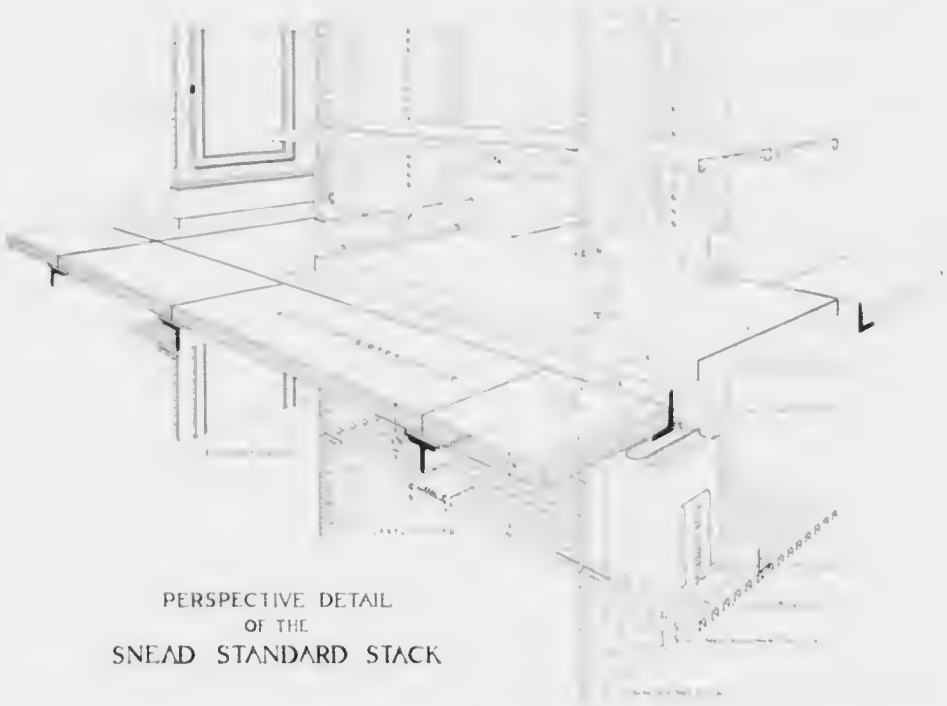


FIG. 28 — VIEW SHOWING SECTION THROUGH DECK FLOORING, FIXED BOTTOM SHELF AND ADJUSTABLE SHELVES

The supporting pins riveted into the front corners of the adjustable shelves are staggered so that two shelves in adjoining compartments can rest on the same shelf support tooth.

The shelves are usually finished with baked black rubber japan, having an eggshell gloss surface. This gives a hard, handsome and durable protective covering. The dull black shelves harmonize well with any color scheme, but if desired, arrangements can be made for supplying shelves of special colors.

The Snead Open Bar shelves have been used for over 95 per cent. of the Snead stack contracts. For the balance solid plate shelves have been supplied. These are made from pickeled, cold rolled and patent leveled steel plates having a smooth even surface. They are flanged on all four edges to obtain the requisite stiffness and adjust in the same manner as the Open Bar shelf. It is customary to finish these also in black rubber japan.

Metal shelves have supplanted wooden shelves in the modern library, as suitable wood is now more expensive and is not so strong, durable or safe.

At the bottom of each shelf compartment a solid fixed shelf extends from one side of the range to the other and forms a structural feature of the bookstack, being secured to the shelf supports to hold them at the proper spacing. The fixed shelf serves as a fire and dust

stop between tiers and is necessary for the protection of the books on the shelves below. This purpose of the fixed shelves cannot be properly fulfilled by adjustable shelves, as is evident from an inspection of the multiple tier bracket stack shown in Fig. 104, page 61. As a rule, when horizontal deck slits are used the top of the fixed shelf is 2 inches above the deck floor level, and with vertical deck slits 4 inches.

SNEAD "OVER-SIZE" SHELF

When classification makes it necessary to store both large and small books in the same range, extension shelves are provided for the over-size volumes as shown in Fig. 29. These shelves are like the regular shelves, except that the corner pins are set further back on the ends in order that they will engage in the teeth of the shelf supports. They are supplied in various standard widths as required. To keep a shelf from tilting forward, when the projection is extreme, back clips may be used to hold down the back edge. See Fig. 96, page 59.

SNEAD OPEN BAR SHELF WITH DEEP BARS

Several times within the past few years there has been a call for an Open Bar shelf which would carry excessive weights much greater than those to which the ordinary library shelf is subjected. To meet this requirement an Open Bar shelf has been constructed in which the bars are of greater depth than those generally employed. The increase in strength and stiffness is shown in both the table and the chart on page 30.

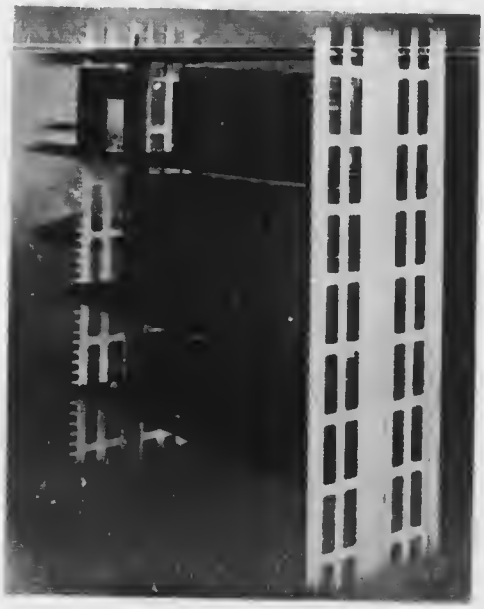


Fig. 29 SNEAD "OVER-SIZE" SHELF

Showing 8" and 12" books in the same range

TESTS ON SNEAD OPEN BAR SHELVES, SHELF PINS AND HORN LOCKS

The following tests, conducted by the Engineering Department of Columbia University, New York City, will serve to illustrate the strength of Snead Open Bar shelves. A comparison of curves "C" and "A" in Fig. 30 shows a marked advantage of the deep bar shelf over the shallow bar shelf of the same length. Curves "B" and "A" show a shelf 3 feet 6 inches long with deep bars to be stronger than a shallow bar shelf only 3 feet in length. Note, in the following table, that the Elastic Limits of these shelves are several times in excess of the loads which they would ever have to carry in a library.

That shelf pins and horn locks are of sufficient strength to carry the shelf when loaded to its Ultimate Strength was proved by these parts remaining in good order after the shelves had failed under the Maximum Load.

TABLE OF WEIGHTS AND DEFLECTIONS FOR SNEAD OPEN BAR SHELVES

	SIZE OF SHELF					
	[illegible] x [illegible] (Bars three-eighths inch deep)		[illegible] x [illegible] (Bars three-quarter inch deep)		[illegible] x [illegible] (Bars three-quarter inch deep)	
DEFLECTION	Concentrated center load in pounds	Distributed load over entire shelf in pounds	Concentrated center load in pounds	Distributed load over entire shelf in pounds	Concentrated center load in pounds	Distributed load over entire shelf in pounds
[illegible] inch	20	40	40	60	40	80
[illegible] "	40	80	60	120	80	160
[illegible] "	80	160	90	180	130	260
[illegible] "	110	220	120	240	180	360
[illegible] "	130	260	160	320	230	460
[illegible] "	170	340	190	380	280	560
[illegible] "	210	420	220	440	320	640
[illegible] "	240	480	250	500	370	740
Elastic Limit	380	760	450	900	490	980
Ultimate Strength	540	1020	500	1000	540	1080

NOTE. When shelves are to be *extraordinarily* loaded, they are given a slight upward camber. This bend takes care of the deflection and causes the shelf to become level when loaded.

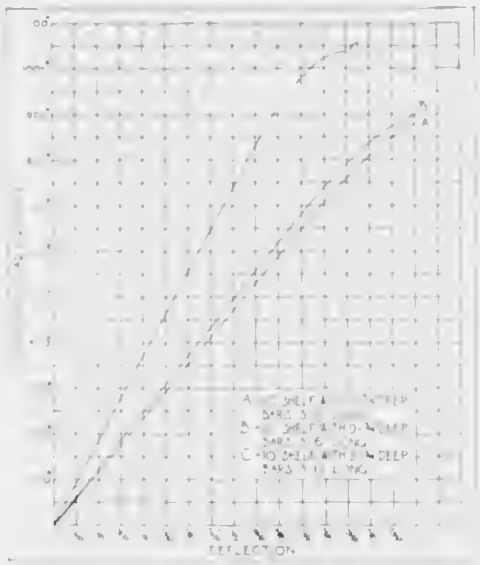


Fig. 30 DEFLECTION OF SNEAD OPEN BAR SHELVES

Fig. 31 DIAGRAM OF TEST ON SHELF PIN

In four separate tests conducted as shown in Fig. 31, shelf pins showed an average Ultimate Strength of 375 pounds each.

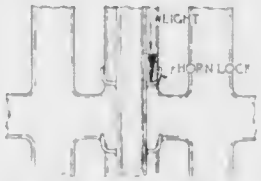


Fig. 32 DIAGRAM OF TEST ON HORN LOCK

In four separate tests conducted as shown in Fig. 32, horn locks showed an average Ultimate Strength of 330 pounds each.

These tests show that each horn lock and shelf pin is capable of sustaining more than its share of the total distributed load carried by any of the above mentioned shelves.

FINISH ON METAL WORK

LIBRARY bookstacks, being built of iron and steel, have to be given some kind of protective covering to prevent rusting. When properly applied, the protective covering can be made to give a handsome effect and also increase the serviceableness of the shelving by forming smooth, light reflecting surfaces.

A unique feature of the Snead Standard Stack is the method of finishing the metal. The adjustable shelves are dipped in dull black japan and baked in ovens at the shop, but all fixed parts are painted by hand after erection and finished with air drying enamel or bronze. The method of dipping and baking is economical and permissible for such movable parts as shelves, which are little exposed and which can be shipped away for refinishing if necessary. Pigment colored enamel may be used for the shelves if desired but black japan is better as it has an asphaltum base which can be baked extremely hard under a high temperature and the rubber colored finish does not readily show scratches.

FIG. 13 CAST IRON RANGE FIN. GRAINED TO HARMONIZE WITH OAK

As a rule, metal finished in imitation of wood is not recommended

Only an air drying finish should be used on the fixed parts of a stack in monumental and permanent buildings. It is better than baked enamel because it is equally hard when thoroughly dry, is more elastic and can be repaired or renewed in place. Aluminum bronze is particularly recommended on account of its durability, velvet-like texture and excellent light reflecting qualities. No finish that can be applied to metal will last as long as a substantial building. Exposed parts are bound to show the wear of use and the scars of accidents. A stack with fixed parts finished in baked enamel is liable to injury in shipment and erection, grows more shabby from year to year and the enamel chipped off leaves unprotected metal. The baking process cannot be repeated after the members are erected and attempts at repairing by other methods are entirely unsatisfactory. Only a few darker colored baked enamels are durable or practicable. Air drying finishes, however, may be had in any color required but white or light gray is the best.

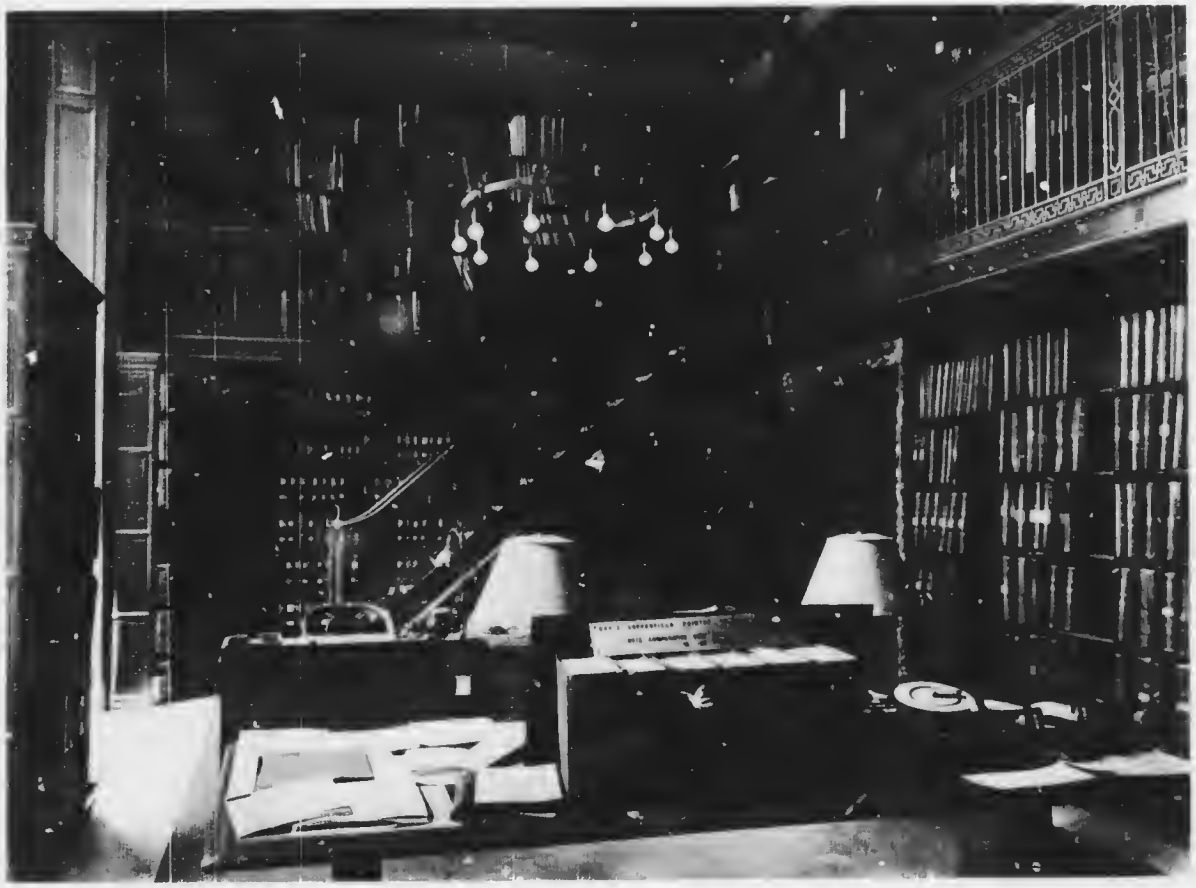


Fig. 34. READING ROOM FOR THE BLIND, NEW YORK PUBLIC LIBRARY

The arrangement of gallery shelving gives a large book capacity without greatly detracting from the available table space. It costs more per lineal foot than if the books are stored in double faced ranges.

SHELVING FOR SMALL LIBRARIES

METAL shelving has entirely supplanted wood for stacks more than one tier high and is now rapidly taking its place for small installations of wall shelving or a few double-faced ranges. Good lumber is expensive, while the price of iron products has been dropping with improvements in methods of production. As a consequence the best metal shelving may now be purchased for no more than first class wood work, provided special construction and unusual sizes are not required. Aside from all considerations of cost, metal shelving is preferable on account of its fireproof qualities, durability, compactness and convenient adjustment. The warping and cracking of wood and the liability of its being scarred in use cause constant expenditure for the upkeep of wooden shelving.

Shelving but one tier high can be made to receive a future second tier, if desired. In this case the cornice is removable and may be used again on the completed stack; and the necessary holes in the uprights, for the attachment of the future deck floor construction, are also provided. See Fig. 37.

The shelf supports of wall shelving may be cast with notches to fit over the base board and chair rail and close against the wall so that the use of steel backing plates, which form inaccessible dirt pockets back of the case, is unnecessary. In this way the wall forms a backing for the books, expense is saved, and ranges can be made more compact than if backing plates are used.

Fig. 35 CHILDREN'S ROOM, NEW YORK PUBLIC LIBRARY
Low 9' shelving around walls. Special design ends and cast iron cornice. Similar low shelving, usually about 4' 6" high, can be furnished of the designs shown on pages 22 and 23.

The stacks for one tier installations may be finished either at the shop or after erection. The latter saves some expense in packing and avoids the necessity of injuring the enamel by handling. The work of finishing after erection can be done by any first class painter following directions furnished and with this method it is easy to have the stacks conform to any color scheme desired.

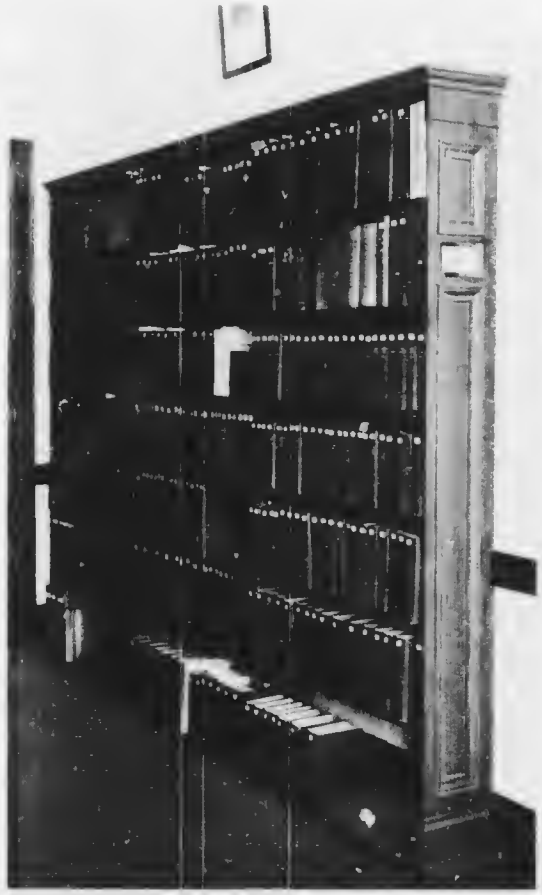


Fig. 96. SINGLE FACED RANGE

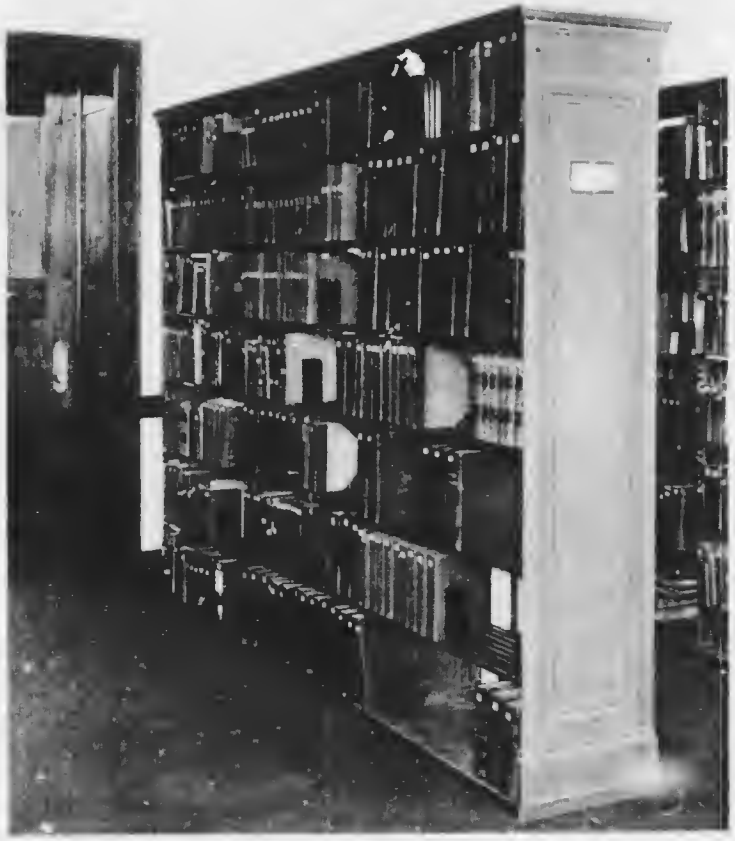


Fig. 97 DOUBLE FACED RANGE

SNEAD STANDARD STACK WITH REMOVABLE CORNICE, PREPARED TO RECEIVE FUTURE SECOND TIER

Holes are provided for the attachment of future deck floor framing. Cornice can be reset on future tiers above. Ranges 6′ 10″ high. Usual height, 7′ or 7′ 6″. Shelves 8″ wide. Similar ranges furnished for shelves 10″ and 12″ wide. Ranges also furnished with end shelf supports of the designs shown on pages 22 and 23.

Fig. 38 — 16 COLONIAL DESIGN

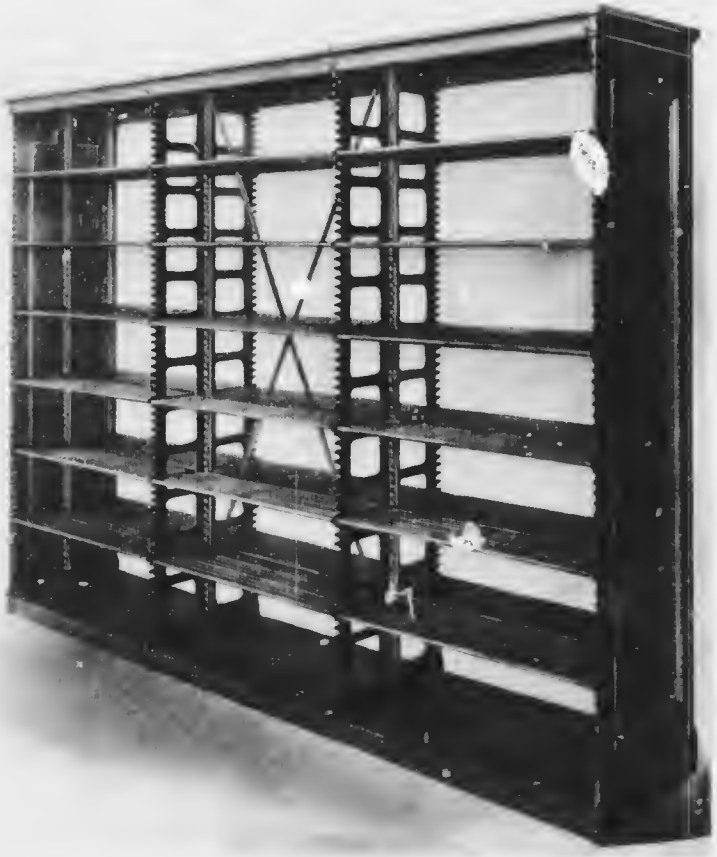


Fig. 39 — 20 SOLID PANELED DESIGN

SNEAD STANDARD STACK, WITH UNIT SYSTEM BASE AND CORNICE.

Length may be altered at will by combining different numbers of shelf compartments. Furnished in the variety of designs and sizes shown on pages 22 and 23. When a second tier may be required, the top finish shown in Figs. 51 and 55 on page 41 is used.

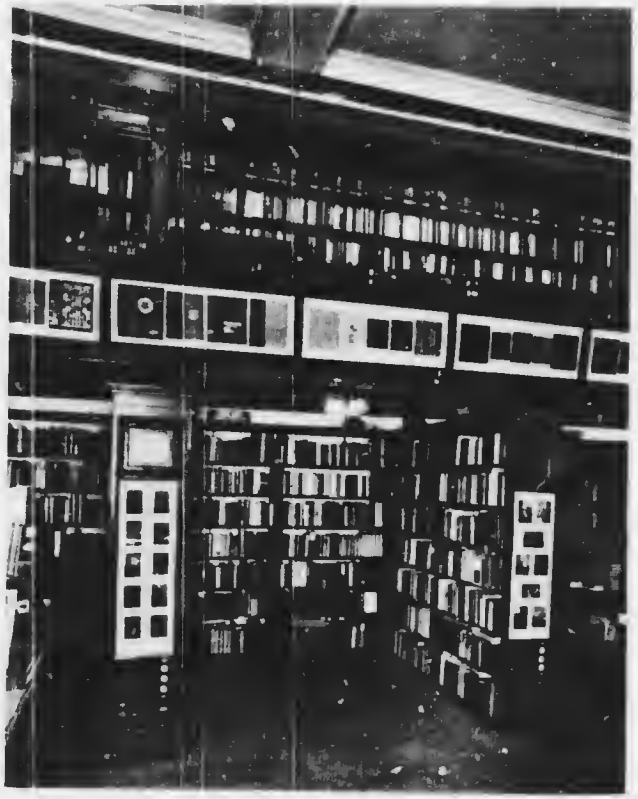


Fig. 10 G. P. PUTNAM'S SONS CO., N. Y.
15th ST. BOOK STORE

View illustrating the way in which the Snead Standard Stack can be adapted to commercial uses. Double faced and single faced ranges form alcoves on the main floor and single faced wall ranges are carried around the balcony, on both sides of room. This arrangement permits thorough supervision and gives large book capacity. The compact, easily adjusted, metal shelves have a great advantage over wood in convenience and safety. The offices are located in the rear, on a mezzanine floor over stack ranges.

Fig. 11 ALBERTA PARLIAMENTARY BUILDINGS
EDMONTON, ALBERTA

Double faced ledge ranges with Unit System base and cornice. This construction is suitable for rooms where the maximum book storage is required and where [illegible] too low to receive a two-tier stack. It is more expensive per lineal foot of shelving than ranges without ledges. Height may be varied from about 10 feet to 13 feet. Above 13 feet a two-tier stack should be used. Shelf widths as required. Upper shelves reached by rolling steps or by rolling ladders attached to tracks at top of ranges. See Fig. 343 page 261

Fig. 12. AMERICAN CIRCULATING LIBRARY, MANILA, P. I.

Double faced ranges, with removable steel cornice, prepared to receive additional tiers if the library is moved into a new building.

Fig. 13. RHODE ISLAND MEDICAL SOCIETY, PROVIDENCE, R. I.

Wall ranges, with Unit System base and cornice.

Fig. 44 MAIN READING ROOM, NEW HAMPSHIRE HISTORICAL SOCIETY, CONCORD, N. H.

Steel shelving, with ornamental cast bronze facing, designed to harmonize with the architectural details of the room.

SPECIAL SHELVING

SOMETIMES it is desired to make a bookstack of a special design to meet particular architectural requirements or conditions of use. The system of using cast iron for the uprights gives unsurpassed opportunities for producing rich effects, without excessive cost, on account of the ease with which a pattern is duplicated. In this way the architects' personality can be worked into the design of an exposed stack, thus enhancing the artistic character of a building. Once the pattern is made, range fronts of special design (see Frontispiece opposite page 11 and Figs. 14 and 17 on pages 38 and 40) cost no more per pound than those from regular stock patterns. With cast iron, all ornamentation is actually part of the structure and is not merely applied as in the case of sheet metal; furthermore, the uprights have a solid, substantial appearance rather than the "tinny" look of sheet metal construction.

With stacks of special design, it is usually necessary to employ finishes which will harmonize well with the interior treatment of the rooms in which the work is located. This is not always practicable with sheet steel construction which is necessarily finished with baked enamel; with cast iron construction, however, the air-drying finishes applied after the stack is erected make it possible to obtain any tone of color or any combination of colors which may be desired. Bronze powders of various kinds are available which, when used on well finished cast iron, produce particularly attractive effects, preserving the interesting texture and metallic quality of the surface covered. A bronze finish of particular merit is obtained by using a gold bronze stippled with dark brown and a touch of green. This finish, while in no way an imitation, gives an effect which resembles old bronze.

Fig. 45 SLIDING SHELVES, NEW YORK PUBLIC LIBRARY
Ends of main stack room are equipped for storage of maps and prints either loose or in boxes. Shelves slide in grooves with rollers to prevent jamming. In a simpler form, rollers are omitted and shelf spacing fixed

When shelving or equipment of a special size is required and the quantity does not justify making new patterns to produce the work in cast iron, it may be made of cold rolled steel plates. With standard dies and mechanical equipment, it is possible to form sheet steel members in a wide variety of sizes at a moderate expense. For the sake of economy and in order to coat the interior surfaces of hollow members, all sheet steel work is finished at the shop with baked enamel.

Fig. 46 PERIODICAL CASE, HARTFORD, CONN., MEDICAL SOCIETY

Cold rolled steel finished in baked enamel. Level shelves, just below sloping shelves, permit back numbers to be compactly stored close to current numbers. As seen in the above sketch, all shelves are so constructed as to allow them being set either level or sloping.

Fig. 47 PATENTS ROOM, NEW YORK PUBLIC LIBRARY

Range fronts, corners, stairway and railings are of special design, made expressly for the New York Public Library. Reading tables have been placed in the open space directly in front of the stack ranges, affording convenient working space in close proximity to the open shelves.

Fig. 48. SUPREME COURT LIBRARY, WISCONSIN STATE CAPITOL.

Unit system of construction. Cast iron cornice and steel base designed so that length of ranges may be altered by changing the number of shelf compartments. This special design is more costly than unit system with steel cornice shown on page 35.

Fig. 49. SNEAD STANDING DESK, ONTARIO LEGISLATIVE LIBRARY.

View in office of the Assistant Librarian. Snead Standing Desks, either single-faced or double-faced, are equipped with open bar or solid plate shelves as desired. These are adjustable at intervals of 1" and lock in place in the same manner as in the regular bookstack construction. The sloping counter is fitted with a grooved ridge along the top for pencils pens, etc. In the background is shown a Unit System wall range with ledge. A better view of this type of range is shown in Fig. 41 on page 36.

Fig. 50. CHILDREN'S ROOM, NEW YORK PUBLIC LIBRARY

Low book cases with plate glass doors. Similar cases of full height and double faced, built to order

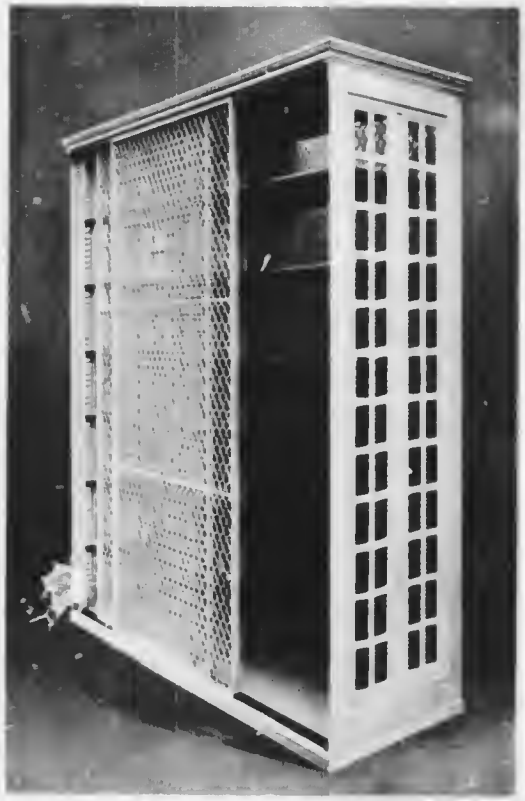


Fig. 51. LIBRARY OF THE PHILIPPINES AND BUREAU OF EDUCATION, MANILA, P. I.

Book cases, with open ends and sliding wire mesh doors for [illegible]

Fig. 52 DETAILS OF SNEAD STEEL LIBRARY SHELVING

This shelving is made of fine cold rolled steel plates, in any size required, and is finished with baked enamel. It is used throughout the miscellaneous rooms of the Widener Library at Harvard.

Fig. 53. PHIPPS PSYCHIATRIC INSTITUTE, BALTIMORE, MD.

This illustration shows freestanding, double-faced ranges made of cold rolled steel plates, the construction being similar to that described above, in Fig. 52. Usually, this construction is considerably cheaper than the regular Snead Standard Stack with cast uprights.

TOP FINISH

THE tops of ranges, over which there is no present deck floor, may be finished in any of five different methods. Each finish has been designed to fulfill the requirements of a definite condition: for a stack supporting superimposed loads, for a stack planned with an idea of future expansion or for a finished stack over which there is to be no future construction. They are as follows:

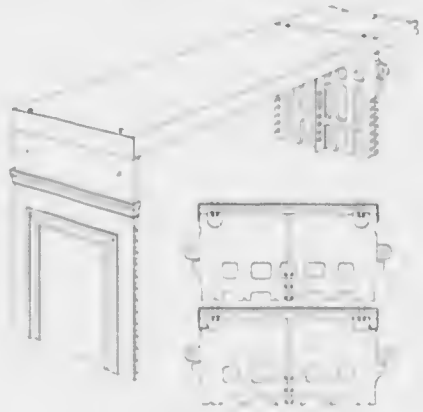


Fig. 54 FLANGED STEEL COVER PLATE

FLANGED STEEL COVER PLATE

The ranges of a tier intended to receive one or more superimposed tiers are provided at the top with flanged steel cover plates to tie together the shelf supports and to serve as the bottom fixed shelves of the future tier above. These flanged plates make a neat utilitarian finish and serve to protect the books from large accumulations of dust and other injury. They permit the next tier being added with no disturbance to work in place.

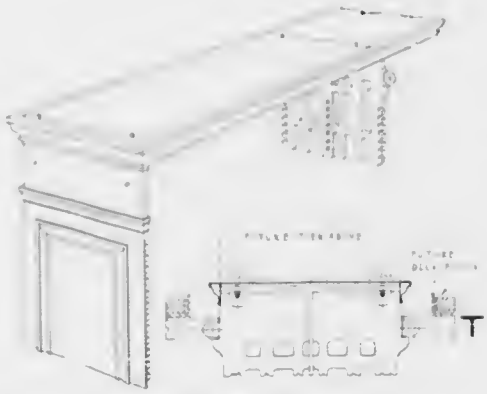


Fig. 55 REMOVABLE STEEL CORNICE

REMOVABLE STEEL CORNICE

If it is desired that an incomplete stack have a more finished appearance, until the future tiers are added, a temporary cold drawn steel cornice can be attached to the flanged steel cover plates described in the preceding paragraph. This cornice is made with mitred and welded corners so that it will stand moving and may be used again on the completed stack.

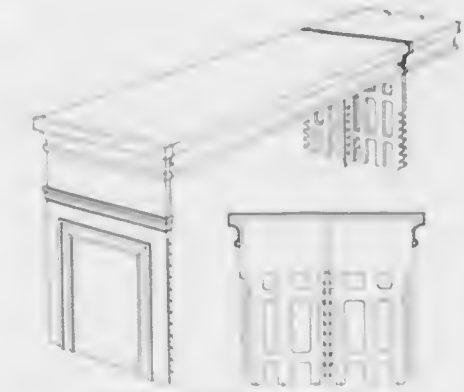


Fig. 56 UNIT SYSTEM CORNICE COVER PLATE

UNIT SYSTEM CORNICE COVER PLATE

A completed stack is usually finished with steel cover plates pressed along the sides into a cornice form, corresponding to the cast cornices on top of the shelf supports. This is less costly than the removable steel cornice construction.

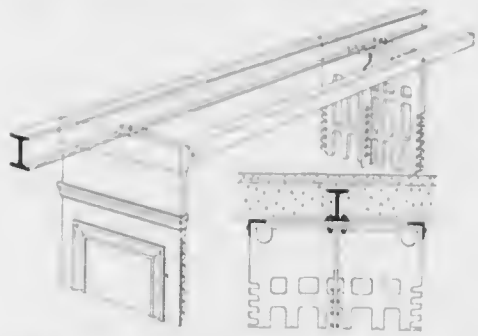


Fig. 57 TOP ANGLES

TOP ANGLES

A stack carrying a floor above is usually left open on top to facilitate the connection of the floor beams with the stack uprights. $1\frac{1}{2}$ inch steel angles are bolted to the upper corners of the shelf supports and hold them in proper spacing.

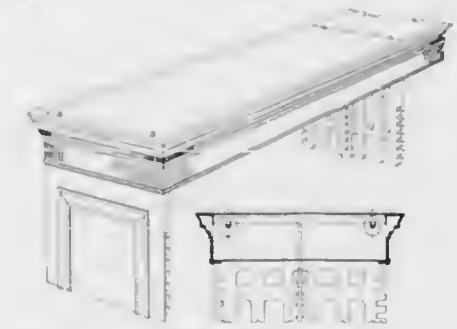


Fig. 58 CAST IRON CORNICE

CAST IRON CORNICE

Where architectural considerations require decoration on a cornice or fine sharp mouldings, cast iron is used. A cast cornice may be designed as desired and it makes a more substantial, solid appearance than steel, but at a greater cost. The cornice can be built in unit sections to permit alteration in the length of the ranges as shown in Figs. 48 and 322 on pages 41 and 247. Soffit plates forming a ceiling to the compartments are frequently used with cast iron cornices and may be used with the steel cornice also.

TOP CLEARANCE

A space of one or two inches is usually left between the top finish of the ranges and the ceiling of the stack room so as to permit the connection of the cover plates or cornice to the shelf supports.

STACK FLOORS

DECK FRAMING

DECK floors are one of the characteristic features of a bookstack. They consist of thin slabs of marble or glass supported on all four edges by light framework. The upper sides of the slabs form the deck floor surface and the under sides the ceiling of the tier below. Those edges of the slabs which are adjacent to deck slits or other openings are bordered by curb angles projecting about 1 inch above the slabs to prevent dust and litter on the floor from falling through the openings. The framing consists of rolled steel angles, T's and bars. Channels and I beams are avoided as much as possible, as their lower flanges catch dust. The main girders of the floor framing are bolted to the vertical shelf supports, and supported by them. Girders adjacent to masonry walls are usually anchored at intervals of about 8 feet so as to tie walls and stack together.

The weights and sections of the floor framing members are varied to suit different spans and floor loads, the framing being designed to make the decks as compact as possible and to give the maximum head room below. The strength must be sufficient to prevent any noticeable deflection or vibration, which tends to open the joints between the floor slabs and derange the construction of the stack. The framing is usually made strong enough to carry a live load of from 40 to 75 lbs. per square foot over and above any dead load. When $\frac{3}{4}$ inch glass slabs are used for flooring the usual thickness from the top of the glass to the bottom of the framing is $3\frac{1}{2}$ inches. When $1\frac{1}{4}$ inch marble slabs are used the thickness is 4 inches. These figures allow $\frac{1}{4}$ inch for the cement bedding. Holes for the passage of horizontal conduits carrying electric wires may be drilled through the floor bars at the shop so that electric light fixtures can be placed close against the soffit of the floor slabs, leaving ample head room beneath. See Fig. 24 page 25. This method makes the neatest construction.

DECK FLOORING

Flooring for bookstack decks should be non-combustible, solid, noiseless and easy to keep clean. It should either transmit or reflect light, and be strong enough to sustain stack room loads unsupported except along the four edges of each slab. Wood should never be used as it is highly inflammable, noisy, a veritable dirt collector, and absorbs light. The first stack flooring in general use was made of perforated cast iron slabs for the sake of ventilation and light transmission. This type was soon abandoned however, because of its costliness, its propensity for sifting dust onto the aisles beneath and because the invention of deck slits made perforated slabs unnecessary for ventilation.

White marble and rough plate glass are the only materials that have given satisfaction. Of the two, marble is preferable. It is stronger, handsomer, feels better under foot and is a better reflector of light than glass. Pure white marble is expensive and difficult to keep clean. That most commonly used for stack decks is blue-white in color, does not readily

show foot marks and gives sufficient reflection. For strength, compactness and reasonable cost, $1\frac{1}{4}$ inch is the best thickness. The slabs are thoroughly bedded in especially prepared cement, with even, neatly pointed joints, and are given a fine sand-rubbed finish on both sides. See Figs. 107 and 152, on pages 70 and 146, showing marble floors.

In skylighted stacks, glass has one advantage over marble: it will allow light rays to pass down through one or two stack decks. Glass slabs are as a rule $\frac{3}{4}$ inch thick, never less. They should be cast on a heavily sanded table to obtain a surface that obscures vision and makes a fair footing. The sand-blasted glass sometimes used is not so good as it collects more dust and becomes nearly black with use. Properly bedded in special cement on a firm steel framework $\frac{3}{4}$ inch glass gives sufficient strength for stack room use though it may crack if a heavy object is dropped upon it. Where conditions require special strength and prohibit the use of marble, 1 inch glass slabs or $\frac{3}{4}$ inch wire glass slabs may be used.

Formerly, glass was sometimes laid smooth side up to show straight cut edges and expose a surface easily kept clean. This practice was abandoned later because – owing to the waviness of the top surface – it was impossible to lay adjacent slabs with flush tops, and because persons walking over the smooth surface became so charged with static electricity that results on touching metal were discomforting. See Fig. 125 page 90 showing glass floors.

Slate has all the advantages of marble, except handsomeness and power to reflect light. This latter deficiency may be partly obviated by painting the under surface white. Slate slabs $1\frac{1}{4}$ inches thick are cheaper than either marble or glass and are sometimes used on this account.

BOTTOM FLOORS

The bottom floor of a stack room is not usually included in the stack contract, as it can be more economically built by the masonry contractor. It is important to have this floor absolutely level as a bookstack cannot practically be made to conform to irregularities except by "shimming up" underneath the shelf supports and leaving openings below the flanges of the fixed bottom shelves.

The bottom floor is usually made of concrete with a cement top finish. This does fairly well, though it is somewhat too dark in color and creates dust when worn. The use of cement paint will prevent the floor wearing, but is apt to give a slippery surface. Terrazzo makes a good bottom floor and to save expense it may be laid only in the aisles, after the stacks are erected, leaving the rough floor under the ranges. Marble tile, similar to the slabs used in the decks, makes the best floor. With tile, the stack is erected on the rough floor, using high stools and deep flanges on the bottom fixed shelves. The flooring is then laid so that it covers up the lower part of the flanges and makes a tight joint between the shelf and the outer edge of the tile.

STAIRS AND RAILINGS

STRAIGHT run stairs are recommended for bookstacks and sometimes also the type shown in the stack room of the Ohio State University Library, page 173, where this arrangement fits in with the stack plan. Spiral stairs are costly and unsatisfactory. Winders considerably increase expense and are rarely necessary with stories as low as stack tiers. Economy in space is secured by placing stairs between two double-faced ranges. See Fig. 61, page 49, and plans on page 209. This inconveniences access to shelves adjoining the stairs, but most of the space can be used by substituting for a regular stair railing a simple hand rail supported on brackets, or the ranges may be used from the opposite side as double width shelving for the storage of bound newspapers or large folio volumes. It rarely occurs that the stair requirements for two different stacks are identical; so stairs cannot be made up for stock. There are, however, regular methods of construction which are economical.

Plain stack stairs are commonly made of steel. Better architectural effects can be secured with cast iron, but its use increases the cost. Marble treads are used with marble decks and slate treads with glass decks, or treads may be made of steel and concrete, or of steel plates with linoleum, rubber matting, or "safety tread" covering. Continuous newels, Fig. 60, support the stack deck floors around stair openings and obviate the necessity of deep floor framing for the wide spans which otherwise would occur. The simplest railings are made of pipe, with cast fittings; double lines are used in exposed locations and single lines for window guards or wall hand rails. Railings of plain square bars with pipe handrails give a better effect, Fig. 60. Ornamental railings are not generally recommended for stack room use, as they collect dust, but they are required where a stack is in an exposed location. Figs. 217 and 246 on pages 191 and 208 show stock designs of simply ornamented railings. See also pages 50 and 51. The frontispiece, page 10, and Fig. 31, page 32, show specially designed railings.

Fig. 59 SCIENCE ROOM, NEW YORK PUBLIC LIBRARY
Special design stringers, risers, newels and railing

Fig. 60. Stack stairway in the Delaware State Capitol. Moulded steel stringers, plate steel risers, marble treads, brass pipe hand rail, and continuous tubular steel newels supporting deck floor.

Fig. 61. Denver Public Library stack room, showing space saved by placing stairway between center ranges. These ranges are used from outside face as double width shelving.

Fig. 62 DOUBLE PIPE

Fig. 63 FLORENTINE

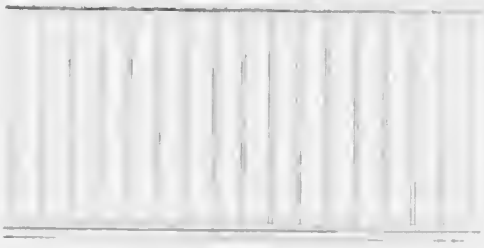


Fig. 64 PLAIN BAR

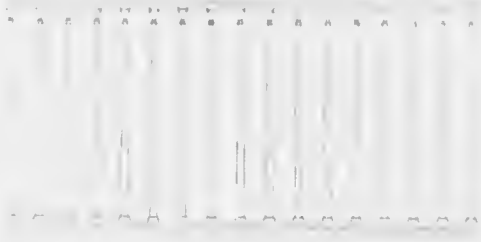


Fig. 65 COLONIAL

Fig. 66 FRENCH

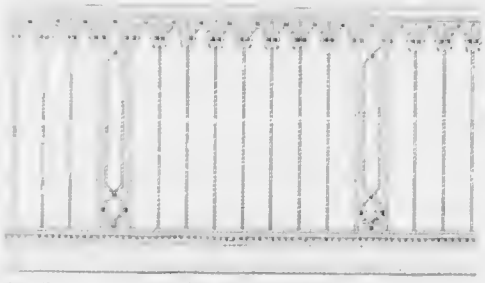


Fig. 67 SECULAR GOTHIC

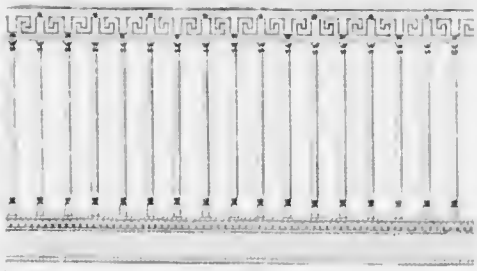


Fig. 68 CLASSIC

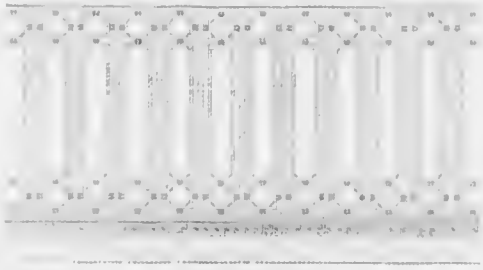


Fig. 69 RENAISSANCE

SNEAD STANDARD DESIGNS OF PLAIN AND ORNAMENTAL RAILINGS AND FASCIAS

Fig. 70 GEORGIAN

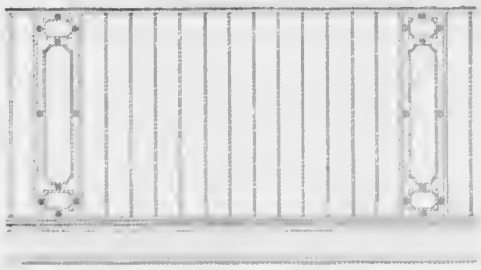


Fig. 71 ORNAMENTAL BAR

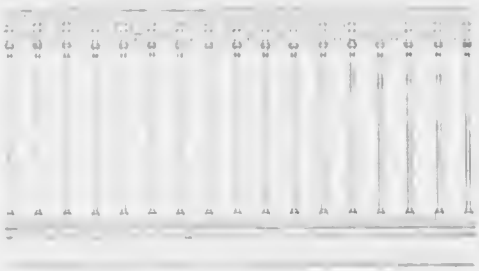


Fig. 72 SPANISH

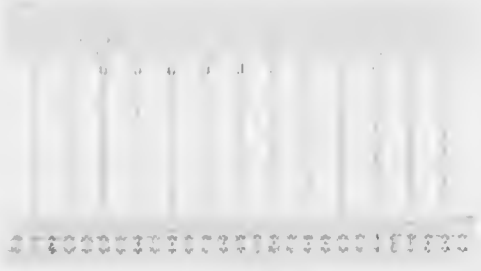


Fig. 73 ENGLISH GOTHIC

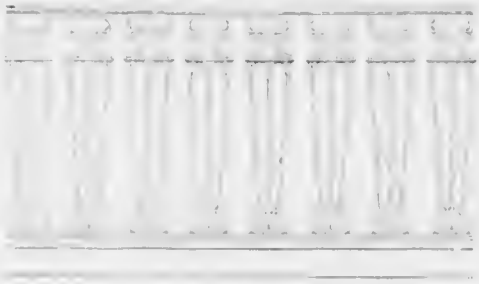


Fig. 74 LOUIS XVI

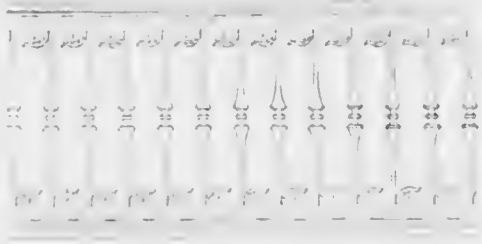


Fig. 75 ROMAN

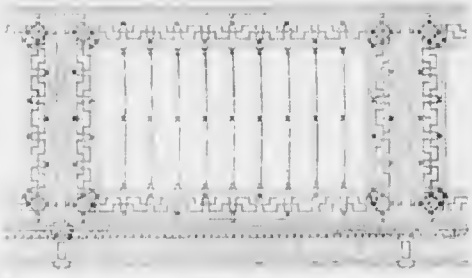


Fig. 76 EMPIRE

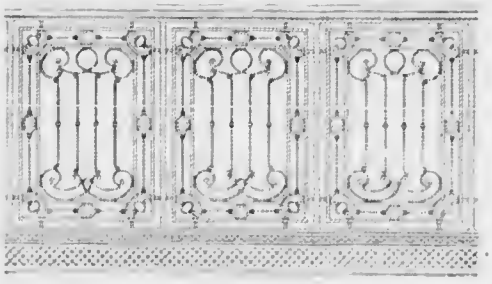


Fig. 77 LOUIS XV

SNEAD STANDARD DESIGNS OF PLAIN AND ORNAMENTAL RAILINGS AND FASCIAS

THE SNEAD NEWSPAPER STACK

THE Snead Newspaper Stack is an adaptation of the Snead Standard Stack to meet the special requirements of large flat books. It is used for newspapers, art books, public, bank and commercial records, large folios, or any volume which is better stored lying flat. As these books require no side support the shelf supports may consist simply of front and back vertical bars carrying the corners of the shelves, the entire central portion being left open for ventilation. Bound newspaper volumes average from 18 inches to 20 inches in width and 21 inches to 26 inches in length. As a rule the shelves are made 18 or 22 inches deep and about 28 inches long. As the shelves are closely spaced, from 4 inches to 6 inches apart, the load per square foot of shelf is small and only a few shelf bars are required. This greatly facilitates ventilation.* The great depth of the shelf compartments, the close spacing of the shelves and shelf supports, the skeleton form of the latter and the wide spacing of the shelf bars form the distinguishing characteristics of the newspaper stack. In other respects it is similar to the standard bookstack. This system of shelving was designed for the nine-tier South East Court Newspaper Stack (the dark stack) of the Library of Congress. See Fig. 81. The central columns are so shaped that they can be made to carry any required floor load, or extended to any height. The construction of the newspaper stack is most compact and dust-collecting surfaces are reduced to a minimum.

Fig. 78 SNEAD OPEN BAR NEWSPAPER SHELF

Width, 18" or 22", length as required, usually about 28"

The shelves have no loose parts, are easily adjusted without tools and every inch of space can be utilized for books. These last two advantages do not always hold for roller shelves, for the latter are frequently difficult to adjust and wasteful of space. The Snead newspaper shelf is thinner than the roller type and its long continuous bars afford a better support for the books than the short rollers. Moreover the open bar shelf holding two or more volumes does not allow

*Mr. John Norris, Chairman of the Committee on Paper of the American Newspaper Publishers' Association, in his remarks before the Committee appointed by the American Library Association to study methods of preserving newspaper files (Brooklyn Public Library Nov. 26, 1912) particularly advocated that newspaper volumes be kept in the dark, thoroughly ventilated and free from dampness, excessive dryness, artificial heat and the products of gas combustion. He commented favorably on the Library of Congress storage arrangements with air spaces around the books, ribbed shelves, filtered air supply and the perfect cleanliness as an insurance against animal organisms.

the bottom book to come out unexpectedly when the top one is being withdrawn, as often happens with roller shelves. The simplicity of the bar shelf construction and adjustment furnishes nothing to get out of order, and makes every portion easy to clean. The newspaper shelves do not lack in strength,—a man may safely walk over them. The smooth rounding of the surfaces not only allows the books to be handled with ease, but also without injury to the bindings.

Roller shelves can be supplied instead of open bar shelves if required. They are designed to fit on the same shelf supports and to take advantage of the easy gravity lock adjustment. The rollers are made of enameled steel or brass. Steel is recommended because it does not tarnish. The shelf frame of the roller shelves is strongly riveted together so that it will remain "square" and always allow a free turning of the rollers.

The Snead Unit System Newspaper Stack is suitable for single-tier installations when a neat attractive appearance is required. There are only five parts to the stack: the end shelf supports, the intermediate shelf supports, the base plates, the cornice cover plates, and the shelves. Under certain conditions diagonal braces are also required. Similar parts are interchangeable, rendering alterations of range length easy. The stack is so simple that any good mechanic can erect it by following the directions furnished. If desired, the solid base plate may be omitted and the uprights fastened to the floor or to light bottom bars. This construction is perhaps more sanitary than with the base. For special architectural effect, the end shelf supports can be made solid with panels and the cornice of cast iron with ornamental mouldings. For simple storage purposes end shelf supports can be made like intermediates with some saving in cost. Shelf lengths can easily be varied to meet particular conditions, such as accommodating the ancient blanket sheets which bind up 31 or 32 inches long.

Accommodation for a small number of newspaper volumes is frequently provided in ordinary shelving by letting the books extend clear through from one side of a double-faced book range to the other, thus making the ranges in effect single-faced. This allows the location of the newspapers to be changed at will. It is objectionable, however, in that regular book shelves are usually too long for newspapers, thus wasting space, and also because half the number of aisles could be omitted had double-faced newspaper ranges been installed at the outset.

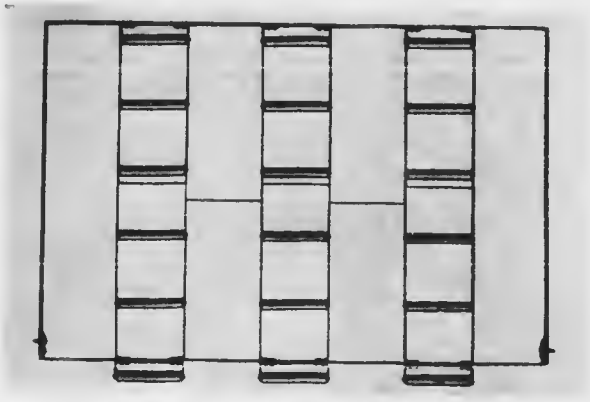


Fig. 79 SNEAD ROLLER NEWSPAPER SHELF
Width 18" or 22"; length as required, usually about 28"

The finish customarily used for newspaper stacks is the same as that used for the book stacks, air drying enamel for the fixed parts and baked enamel for the adjustable shelves.

Metal construction is no more expensive than first class wooden construction and has the advantages of being entirely fireproof and far more convenient, durable and sanitary.

Fig. 80. BOSTON ATHENÆUM NEWSPAPER STACK

Cast uprights joined in center for double faced ranges; no fixed bottom shelves, flanged cover plate top finish. Open construction and wide spacing of shelf bars give thorough ventilation around each volume

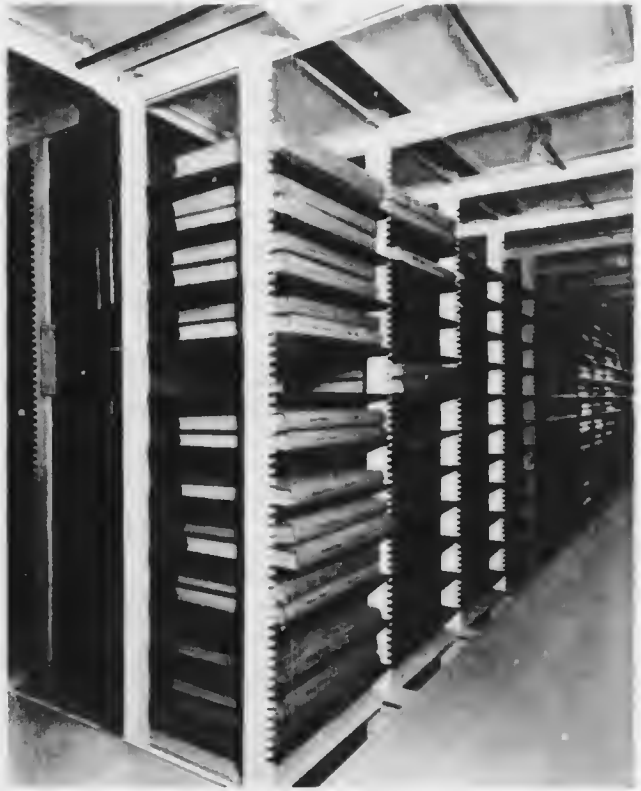


Fig. 81 LIBRARY OF CONGRESS, WASHINGTON, D. C.

View in southeast court, nine tier newspaper stack. Middle uprights are continuous steel columns supporting decks and roof. White marble used for deck floor slabs. Dust collecting surfaces reduced to a minimum

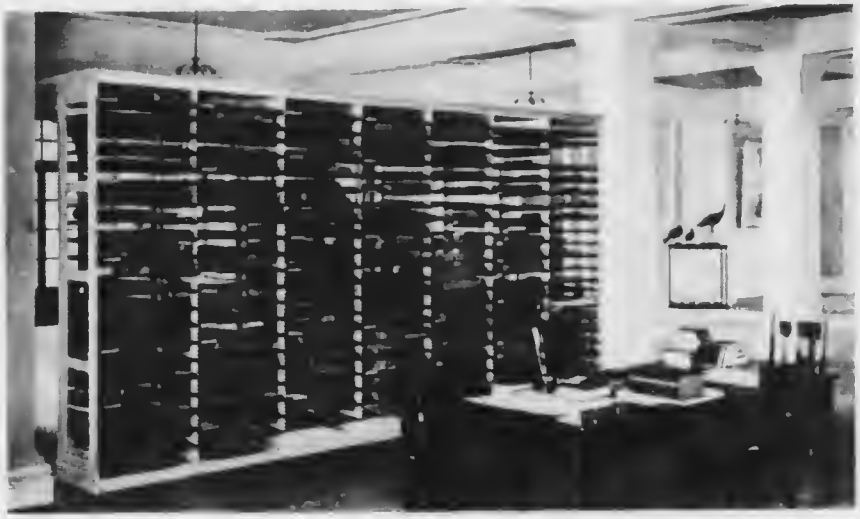


Fig. 82 ALBERTA PARLIAMENT BUILDINGS, EDMONTON, ALBERTA

Single-faced newspaper range with unit system base and cornice designed for the future expansion of the storage system. Range can later be made double-faced

Fig. 83 NEW HAMPSHIRE HISTORICAL SOCIETY, CONCORD, N. H.

Structural columns of building enclosed by double-faced newspaper ranges, with cast iron cornice and base.

BOOKSTACK FITTINGS

Fig. 84—PLATE STEEL BOOK SUPPORT FOR OPEN BAR SHELF

A downward projecting ⊥ shaped key, fitting between any two shelf bars, forms a lock when books press against the top of support. The support is easily adjusted with one hand when grasped at the base. Heights 6" and 12".

Fig. 85—PLATE STEEL BOOK SUPPORT FOR SOLID PLATE SHELF

The support is held in position by the weight of the end books which rest on a flat tongue extending horizontally along the shelf. The flanged vertical edges prevent books "straddling" the support and having their leaves damaged.

Fig. 86—UPRIGHT WIRE BOOK SUPPORT

The ends of the wire project between the bars and hook underneath, forming a back when books press against the top of support.

Fig. 87—HANGING WIRE BOOK SUPPORT

This support, engaging the side flanges of shelf above, extends down and supports the books below. For use with solid plate shelves only.

Fig. 88 SINGLE FRAME

Fig. 89 DOUBLE FRAMES

Illustrations of solid cast card frames with label opening $2\frac{1}{2} \times 4\frac{7}{8}$ inches. Made of enameled iron, polished brass or bronze and held in place by tap screws. Each frame has one end slotted to allow cards to be readily inserted.

Fig. 90 ORNAMENTAL CARD FRAME

Made of finely molded cast bronze, finished as desired. One end slotted to receive card. Label opening $2\frac{3}{8} \times 4\frac{7}{8}$ inches.

Fig. 91 HANGING CARD FRAMES

Hooks at top allow these frames to be readily attached anywhere on open design range fronts. Card opening $3 \times 3\frac{1}{2}$ inches.

Any card frames which may be required should be ordered before the stack is manufactured so that tap holes for securing them in place may be provided at the shop and not have to be drilled after the work is erected.

Fig. [illegible] — OPEN BAR SHELF LABEL HOLDER "A"

Fig. [illegible] — OPEN BAR SHELF LABEL HOLDER "B"

Fig. [illegible] — SOLID PLATE SHELF LABEL HOLDER

Fig. [illegible] — LABEL HOLDER FOR SLOPING MAGAZINE SHELF

Shelf label holders are made of cold rolled steel finished in baked enamel to harmonize with the shelves, or, if specially ordered, are made of sheet bronze or brass. They are readily adjusted by clamping them in place anywhere along the edges of the shelves and are not dislodged when books are handled. The label openings are [illegible]" wide by 1" long and labels are inserted at the ends.

Fig. 95-a — RANGE FRONT WITH PLATE STEEL INDICATOR

TIER, SECTION AND RANGE INDICATORS

Those as shown in Fig. 95-a are made of enameled plate steel and are numbered and lettered to order as desired. The [illegible] wedge shape permits the designations being read from any position in the aisle. The indicators are secured near the tops of the end shelf supports by means of tap screws.

Fig. 95-b shows bronze number plates riveted into recesses and section designating letters cast on the end shelf support. This method of indication while giving a handsome effect is not so clearly read as that shown in Fig. 95-a and is more expensive.

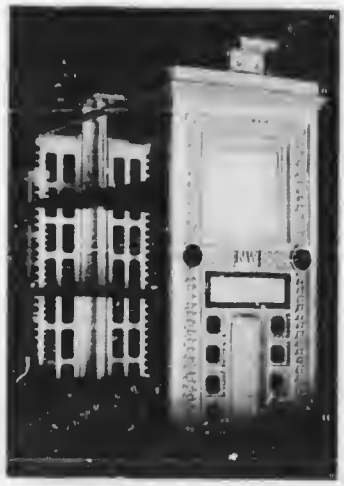


Fig. 95-b — RANGE FRONTS WITH APPLIED AND CAST INDICATORS

Fig. 8. BACK CLIPS

When "over size" adjustable shelves are used a heavy weight on the front edge of the shelf may tilt up the back edge until it strikes the horn lock about ¼" above. This tilting is prevented by the use of back clips which wedge between the back edge of the shelf and the bottom of the horn lock immediately above and hold the shelf firmly in place. These clips may also be used in connection with portable ledges though not required if the ledges are attached to loaded shelves.

Fig. 9. FORWARD BOOK LEDGE

Can be attached to any one of the adjustable shelves to provide a convenient place for consulting books. For convenience of handling, the ledge is usually made of light weight mahogany with steel ends and is finished to match the adjustable shelves.

Fig. 10. BACK STOP

This angle back stop is provided with keys locking between any two shelf bars. It is used to prevent books from being pushed too far back on a shelf and becoming lost, as often happens with small volumes; it also facilitates the even arrangement of books of uniform size, such as law reports. The back stop is particularly useful in open shelf rooms as the public is apt to be careless about replacing books.

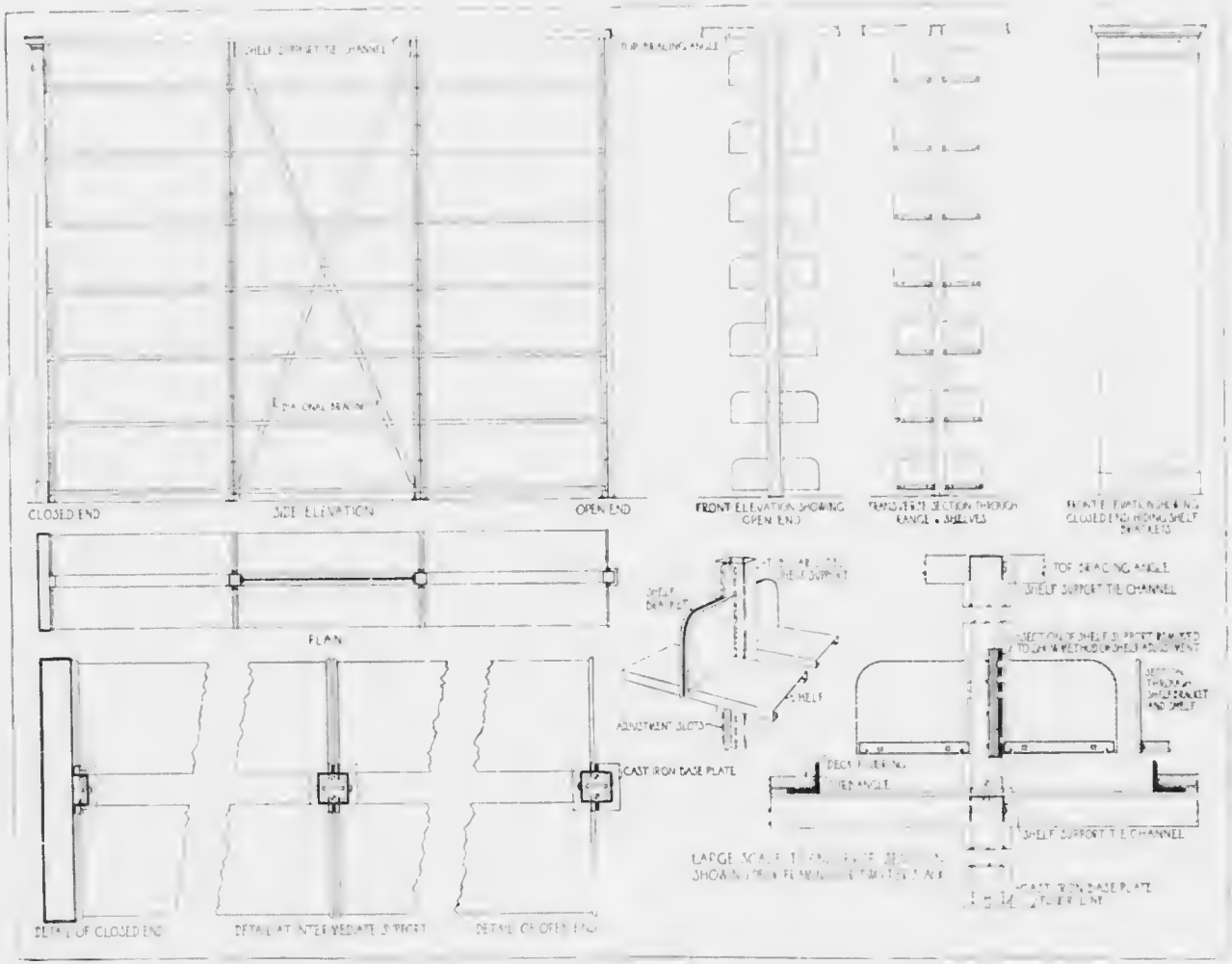


Fig. 99. LARGE AND SMALL SCALE DETAILS OF THE SNEAD TUBULAR STEEL BRACKET STACK

BRACKET STACKS

SNEAD TUBULAR STEEL BRACKET STACK

THIS stack has been designed with the purpose of combining simplicity, lightness, rigidity and strength in a construction less costly than the Snead Standard Stack. It is made entirely of pickled, cold rolled, annealed and patent leveled steel plates, except for the feet of the uprights and the cornice on the full width ends; these parts are made of cast iron.

Fig. 100. SNEAD TUBULAR STEEL BRACKET STACK, EXETER, N. H., PUBLIC LIBRARY

The steel section of the uprights is formed so as to develop the fullest possible strength of the material, the hollow-tube shape giving great rigidity. The feet of the uprights are secured to the floor to prevent displacement, while the tops are braced longitudinally by tie channels, of such stiffness, that transverse bracing between ranges is only necessary at intervals of about three compartment lengths. Full width end shelf-supports act as a cover to hide the brackets of the adjustable shelves. They are frequently used on the ends of those ranges which are particularly exposed to view. The cornice on full width ends is made of cast iron in order to secure the proper fineness of line and beauty of design. Where a number of full width ends are required little is saved by the use of a bracket instead of a standard stack.

The bracket shelves consist of: First; the shelf proper, upon which the books rest. Second: the brackets which carry the shelf in cantilever fashion and hold the end books

upright. Shelves are triple flanged along the front and back edges into a rigid box form, and single flanged on the ends. The brackets are bolted to the end flanges of the shelf. The adjustment of the shelves is accomplished by means of three hooks on the upper back corner and a lug on the lower back corner of the shelf bracket, as shown in the details in Figs. 99 and 101-a. These hooks and lugs engage slots in the uprights; the hooks forming a support and the lug serving to prevent an upward blow from dislodging the shelf. Rounded flanges are pressed on the tops and fronts of the brackets to prevent any raw edges of the material coming in contact with and injuring the books.

Fig. [illegible] Detail of shelf construction and adjustment. Snead Tubular Steel Bracket Stack

Baked enamel, dark green or semi-gloss black, is the finish generally employed. Special colors, however, can be furnished as required. Stairways, deck framing and other structural steel parts are finished with paint or air drying enamel applied after the stack is erected.

Steel bracket construction is particularly adapted for use in a one-tier stack but may be used in stacks of two or more tiers. Where the uprights have to carry heavy superimposed loads they can be strengthened, either by thickening the steel plates from which they are formed or by reinforcing them with structural steel members.

The tubular steel bracket stack is made in any width, height or length. It is inadvisable, however, to go beyond 3 feet 6 inches in the length of compartments, or above 10 feet in the height of the stack. Even at 10 feet several rows of the adjustable shelves are inaccessible.

The simple construction of this stack makes it easy to pack for shipment and any good mechanic can erect it by following the instructions furnished.

Fig. 101-b. SNEAD TUBULAR STEEL BRACKET STACK
View looking toward closed end shelf support

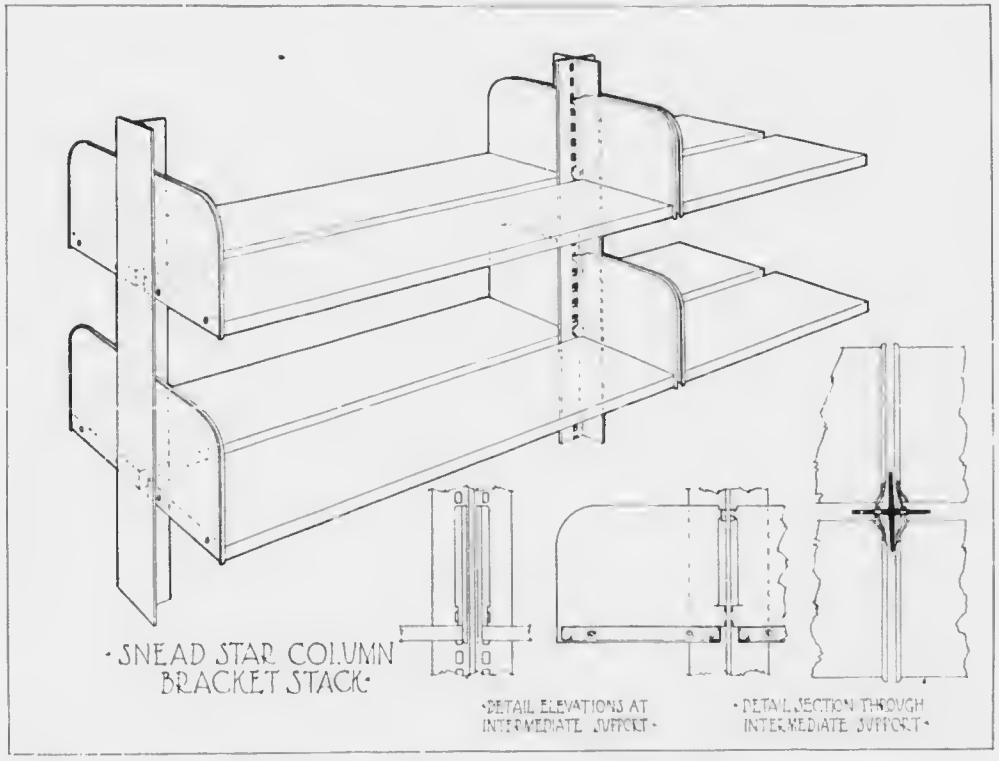


Fig. 102. PERSPECTIVE VIEW AND DETAILS OF SNEAD STAR COLUMN BRACKET STACK

SNEAD STAR COLUMN BRACKET STACK

The principles involved in the shelf adjustment of this stack are similar to those used in the Snead Tubular Steel Bracket Stack. The Snead Star Column Bracket Stack, however, is much stronger and is designed for greater heights or to carry heavy floors. It is too expensive to use in a one-tier or two-tier stack.

The intermediate uprights are of heavy steel star sections, specially rolled for Snead & Company; the ends are of heavy T sections. Adjustment slots are punched in those flanges of the uprights which stand parallel to the face of the range.

Shelves are triple flanged on the front and back edges into a rigid box form and single flanged on the ends. To the end flanges are fastened the brackets which carry the shelves. Hooks and lugs on the back edges of the brackets engage in the slots of the uprights, the hook forming the support, while the lug serves as a guard to prevent dislodging of the shelf by an upward blow. An offset in the back of the brackets allows the shelves to be interchanged throughout the stack and provides for the adjustment of the hooks of opposite shelves in the same adjustment slot. This offset also prevents books coming in contact with the ad-

justment hooks. Round flanges, turned on the front and top edges of the brackets, prevent injury to books.

The distance between the back edges of shelves at the same level in a compartment is only $1\frac{1}{4}$ inches, and the distance between the ends of two adjacent shelves is only $\frac{5}{8}$ inch. This construction affords the greatest compactness possible in the bracket stack, the structural members being kept solid and all waste space being eliminated.

In this type of construction, the shelves are usually finished with baked enamel, and shelf support uprights or columns, steel framing, stairs, etc., with air-drying enamel applied after the stack is erected.

The Snead Star Column Bracket Stack, while cheaper than the Snead Cast Iron Bracket Stack, is more expensive than the Snead Tubular Steel Bracket Stack.

Fig. 103 MEDICAL AND CHIRURGICAL FACULTY OF MARYLAND, BALTIMORE, MD.

View in second tier of Snead Cast Iron Bracket Stack showing stack ready to receive future tiers above. Pilaster design ends.

SNEAD CAST IRON BRACKET STACK

The uprights of the Snead Cast Iron Bracket Stack are solid, substantial and remarkably stiff and strong. Each consists of a single casting neatly molded from patterns parted in the center, sand-blasted, surface ground and filed to obtain the best possible finish. The end uprights are of an attractive pilaster design as shown in Fig. 103 on opposite page. By placing one upright above the other, a stack of any number of tiers may be built.

Fig. 104 LAW LIBRARY, UNIVERSITY OF ILLINOIS, URBANA, ILL.

View at bottom of the five tier Snead Cast Iron Bracket Stack, showing details of bracket shelves and shelf adjustment lugs.

Shelving is formed of pickled cold rolled, annealed and patent leveled steel plates, with triple flanges on the front and back edges. The brackets, also of steel plates, fit against the ends of the shelf and are fastened to the front and back flanges, a portion of the bracket being carried around the back to form a brace. See Fig. 104. This insures a perfectly square and rigid connection and makes it impossible for the shelf brackets to spring from the supporting lugs on the uprights. The shelves are adjusted and held in place by means of hooks, on the back upper corners of the brackets, which engage with lugs on the uprights.

The uprights, framing and stairways are usually finished with an aluminum bronze or air drying enamel, applied after the erection of the stack. A baked enamel finish can be furnished if desired. Shelves are always finished with baked enamel, usually black.

Many prefer this stack with solid cast iron uprights, to the Tubular Steel Bracket Stack, but owing to its greater cost, it is not so generally used.

STANDARD VS. BRACKET STACKS

AS a choice has sometimes to be made between standard and bracket stacks, a statement of their relative merits is in order. The following comparison is not based on any particular makes of stack but on the general features which naturally belong to each of the two types.

The characteristic point of difference between a standard and a bracket stack lies in the form of the shelves and shelf supports. The word "standard" is here used to indicate the broad upright support which holds the ends of the shelves. For the purpose of reducing the cost, the shelf supports of the bracket stack are made as narrow as possible and so have to support the shelves in cantilever fashion. As the post-like supports are not wide enough to cover the ends of the shelves and keep the books upright the shelves are provided with end brackets. While the shelf supports in the bracket stack are cheaper than those of the standard, the bracket shelves are more costly as they are excessively heavy; consequently the difference in price between the two types is not large.

The irregular outlines of the bracket ranges present an unattractive appearance. The unsupported front edge of the shelf gives a suggestion of insecurity which has a basis in reality. The books look as if they might topple over on the slightest provocation. The shelves frequently become dislodged accidentally and have been known to drop on glass flooring and crack it. The brackets themselves sometimes bend or become loose on the shelves so that they do not fit the shelf supports.

The brackets prevent a close adjustment of shelves to hold large folios lying flat and they give an insufficient support to tall books standing upright. In stacks of this type there is danger of straddling the books over the brackets and marring the leaves. The bracket construction is particularly objectionable in a stack room open to the public, as the projecting members are liable to catch on clothing. Considerable book space is wasted between the end brackets, and between the back edges of the shelves. This latter space is sometimes 2 inches or more in width, thus allowing books to drop through.

The desirable features of the Open Bar shelf are never found in a bracket stack, nor do bracket stacks have the fixed bottom shelf at deck floors which serves as a fire, dust and water stop and prevents books falling from the upper to the lower stories. The solid cover plate, which is a characteristic feature of the standard construction, is a great protection to the books from dirt and other injury and is frequently used as an extra shelf when the movable shelves are full. The omission of the cover plates and the fixed shelves between tiers largely account for the cheapness of the bracket type.

Practically all of the first class important library buildings of recent construction have standard stack equipment and for most buildings, proposals are not received for the bracket construction. The only advantage in the latter is a slight economy in first cost, and this is more apparent than real.

LAYING OUT A STACK ROOM

NO absolute rules can be laid down for the arrangement of a stack room. Too much depends on the size and shape of the room and the manner in which it is to be used. A stack open to the public should have more liberal aisle space than a storage stack. The range aisles in an open stack may be approximately 3 feet wide and the main aisles anywhere from 3 feet to 6 feet. Too great liberality in aisle space is expensive in the cost of deck floor construction and limits the book capacity of the whole building. Ample aisle space looks well when a library is new and the shelves only partially filled, but as the books accumulate and the stack becomes crowded to overflowing, all space save that absolutely necessary for aisle room becomes a source of regret to the librarian. The stack of the British Museum is a good example of this: the range aisles were originally about 7 feet wide, but so great became the demand for book space that movable cases were suspended on rollers from the deck floor above each tier. These stood in front of the fixed shelving. This about doubled the stack capacity, but at the cost of making two-thirds of the books inaccessible without first moving one of the heavy rolling cases.

In an open shelf stack room the range aisles may be made as long as 18 feet when open at both ends and 12 feet when "blind" at one end. In a storage stack the ranges may be made as long as 30 feet and the range aisles as narrow as 27 inches to give the maximum book capacity. Although a person can pass through an aisle 21 inches wide, it is difficult to use the lower rows of shelves with aisles under 27 inches. The ranges should be so placed that adjacent shelf supports stand exactly opposite one another across the aisle. If this is not done the floor framing becomes unsymmetrical and costly.

The length of the shelves is largely governed by the dimensions of the stack room. A distance of 3 feet between the centers of shelf supports is usual, but this figure may be varied if necessary. A closer spacing increases both the number of shelves and shelf supports, thereby adding to the cost. The use of longer shelves is frequently warranted, 3 feet 6 inches being quite common.

Fig. 105 OLD STACK ROOM BRITISH MUSEUM, LONDON

Auxiliary cases suspended on rollers.

Stack illustrated was not supplied by The Snead & Co. Iron Works

The double-faced ranges for public, college and law libraries are generally made about 17 inches wide with 8 inch adjustable shelves. A few 10 or 12 inch wall ranges or 20 and 21 inch double-faced ranges may be provided for over-size books, or all the bottom fixed shelves may be widened from 2 to 4 inches as shown in Figs. 2, 17 and 106, on pages 13, 22 and 69. Sometimes ranges are preferred, having projecting ledges about 2½ or 3 feet above the floor, with 10 or 12 inch shelves below and 8 inch shelves above. See page 70. The ledge is convenient for consulting books and does not seriously cut off the most valuable portion of the aisle space.

The stairs and booklift should be in a central location or adjacent to the main entrance. A stairway in the center of a stack room is usually more serviceable than one at each end.

SNEAD VERTICAL (PROTECTED) DECK SLIT

It is a well established principle of bookstack construction that an open space or deck slit should be left between the bottom fixed shelves and the curb angles bordering the stack deck floors so that proper ventilation of the stack room will be possible. In ordinary stack construction this opening is about 3 inches wide, measured horizontally, and it has sometimes been criticised on account of the possibility afforded of objects dropping through the deck.

This objection has been eliminated by the Snead Vertical Deck Slit Construction which has shelf supports widened at the bottom so that the fixed shelves extend over to the edge of the deck floor and entirely cover and protect the ventilating opening, which now extends in a vertical rather than in a horizontal direction. The height of the bottom shelf above the deck floor is usually about 3 or 4 inches, leaving an opening of 1 or 2 inches between the top edge of the curb angle and the bottom flange of the fixed shelf. The wide bottom shelves also afford convenient accommodationf or over-size books right in the same range with the smaller books, and this without encroaching on the valuable portion of the aisle space. It is the width of aisle at elbow and shoulder levels that counts, rather than the width at the floor level.

Furthermore, the upward flowing air currents in a multiple-tier stack carry dust, and if these currents pass through the deck floors along a line several inches in front of the face of the range, the dust particles are not so liable to be deposited on the books.

Another feature of the Snead Standard Stack which can accompany the wide bottom shelf and make it practicable to shelve books right along in their proper order, irrespective of size, is the interchangeability of regular and "Over-size" adjustable shelves. See opposite page and Fig. 29, page 29. The proportion of large books in a library is usually small, so that if the bulk of the shelves are made 8 or 9 inches wide, and all fixed bottom shelves and about 5 per cent. of the adjustable shelves 10 or 12 inches wide, convenient and adequate accommodation can be had for the entire collection, with a minimum waste of space.

The vertical deck slit, wide bottom shelf and interchangeable regular and "Over-size" adjustable shelves were first designed for use in the Harry Elkins Widener Memorial Library of Harvard University, in order that the students and attendants using the stack would not be confused by the classes of books being broken up on account of variation of size. Books on the same subject properly belong together, and it is awkward and needless to separate them simply because one book may be larger than another.

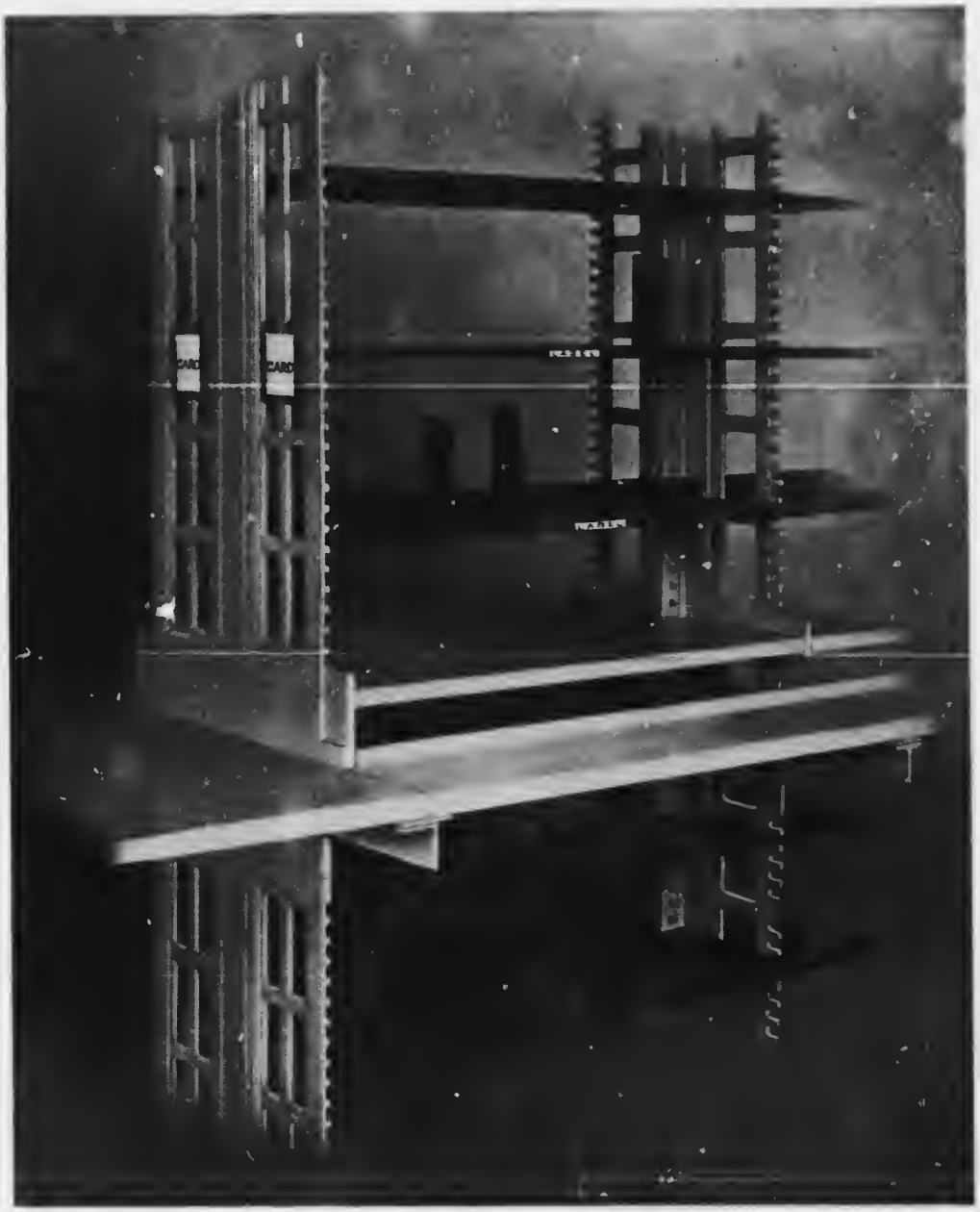


Fig. 106. SNEAD VERTICAL (PROTECTED) DECK SLIT

Section through stack floor, showing top and bottom of typical range, with wide fixed bottom shelf, "Over-size" adjustable shelves and protected Vertical Deck Slit of the Widener Memorial Library. See also Fig. 116, page 80.

Fig. 107 ONTARIO LEGISLATIVE LIBRARY, TORONTO, ONT.

Stack with ledge ranges, continuous marble deck floors (no deck slits) and open design range fronts. Upper shelves 8" wide, ledge 10" wide, lower shelves 13" wide.

WIDTH AND CAPACITY OF SHELVES

NO definite rules can be laid down regarding the width of shelves required for libraries as much depends on the method of classification, space available and usage to which the library is put. Where economy and compactness of storage are important, 8 inch shelving is recommended for bookstacks in general. Books deeper than 8 inches can be taken care of in various ways: by making the fixed bottom shelves from 9 to 12 inches wide; by providing adjustable shelves 9 or 10 inches wide to fit on the 8 inch shelf supports; by providing one or more ranges with 10 or 12 inch shelf supports and shelves; or simply by allowing the books to project a little beyond the front or back edges of the shelves. Most books are 6 inches or less in depth and it is well to bear in mind that waste space back of books collects dirt and is objectionable while the same space added to the width of the aisles becomes valuable.

The number of volumes that can be stored per lineal foot of shelving depends on the character of the books. The following table has been prepared by averaging the data collected from various general and special libraries. For convenience in computing the amount of stack necessary, the capacity for both single-faced and double-faced ranges has been added, this being based on stacks 7 or 7½ feet high with seven rows of shelves, six adjustable and one fixed, in the height.

Kind of book	Vols. per foot of shelf	Vols. per lineal foot of single-faced range	Vols. per lineal foot of double-faced range	Recommended width of shelves
Circulating	10	70	140	8 inches
Fiction	9	63	126	8 "
Economics	9	63	126	8 "
General literature . . .	8	56	112	8 "
Reference	8	56	112	8-10 "
History	8	56	112	8 "
Technical and Scientific .	7	49	98	8-10-12 "
Medical	6½	45½	91	10 "
Law	6	42	84	8 "
Public documents . . .	6	42	84	8 "
Bound periodicals . . .	5½	38½	77	10-12 "
U. S. Patent specifications	2 (144 vols. per year)	14	28	8 "

STANDARD DIMENSIONS

FOR the sake of convenient reference a summary of the regular sizes and dimensions of various stack parts are given below. It is well to take up with the manufacturer any changes that may seem necessary in these dimensions.

STACK TIERS

Heights. 7 feet and 7 feet 6 inches, measuring from deck floor to deck floor.

STACK AISLES

Main. 2 feet 6 inches to 5 feet or more, depending upon shape and size of room.

Minor. 2 feet 3 inches to 3 feet 6 inches or more, depending upon conditions of use.

STACK STAIRS

Straight Runs. Well length, 8 to 9 feet; 11 or 12 risers; width usually about 30 inches.

STACK RANGES

Lengths. As required, preferably in even multiples of shelf length adopted.

Widths. Single-faced, $8\frac{1}{4}$, $9\frac{3}{4}$, $10\frac{3}{4}$ and $12\frac{1}{2}$ inches for books; $18\frac{7}{8}$ and $22\frac{1}{4}$ inches for newspapers. Double-faced, $16\frac{1}{4}$, $18\frac{3}{4}$, $20\frac{1}{2}$ and $24\frac{1}{4}$ inches for books; 37 and $41\frac{1}{4}$ inches for newspapers.

RANGE CORNICES

Depth. 2 inches for drawn steel, 3 inches for "Unit System."

SHELF SUPPORTS

Thickness. Of intermediates seven-sixteenths inch, of ends five-eighths inch. Central stiffening ribs about 4 inches wide. Cornices project about 1 inch beyond face of ends.

ADJUSTABLE SHELVES

Lengths. As required, usually about 3 feet, uniform if possible; maximum about 3 feet 6 inches.

Widths. 8, 9, 10 and 12 inches for books; 18 and 22 inches for newspapers.

Thickness. $\frac{5}{8}$ inch to $\frac{3}{4}$ inch; greater for long span, solid plate shelves.

FIXED BOTTOM SHELVES

Height from deck. 2 inches with horizontal, 3 or 4 inches with vertical deck slits.

ELECTRICAL ARRANGEMENTS

Vertical ducts. On end shelf supports, $\frac{1}{2}$ inch x 2 inches in cross section.

Switch boxes. On end shelf supports, for single or double switches as required.

Horizontal conduits. For main feeds, sizes as required; for branches $\frac{1}{2}$ inch round (actual diameters, internal .623 inch, external .84 inch)

DECK FLOORS

Glass Slabs. Usually $\frac{3}{4}$ inch thick, sometimes 1 inch thick for large spans.

Marble Slabs. $1\frac{1}{4}$ inches thick. Slate, if used, same thickness as marble.

Total Thickness. For ordinary spans, measuring from top of slabs to bottom of steel beams; with glass, $3\frac{1}{2}$ inches; with marble, 4 inches.

PRICES OF STACKS

INQUIRIES regarding shelving installations frequently take this form: "We are about ready to equip our stack room; please send catalog and prices." It is easy to send a catalog but impracticable to give a satisfactory estimate of prices without some specification of requirements. Stacks are built to order, to fit each library. Consequently each contract must be estimated separately. The cost varies from 40 cents to $1.00 or more per lineal foot of shelving for straight stack work. The arrangement of the stack room, length of ranges, width of shelves, height of tiers, number of rows of shelves, number and position of stairways and booklifts, freight rates, packing charges and market price of steel, are only a few of the many factors which enter into the cost estimate. It is, therefore, almost impossible to quote list prices and discounts which will be intelligible and accurate. In requesting an estimate, architect's plans and sections should be sent. If these are not available, sketches with figured measurements will do. There should be a full description of the requirements of the library and the condition of the room. The more particulars given, the easier becomes the task of making a close and satisfactory estimate. For stacks but one tier high the following data is required: Standard or bracket type. Number of ranges. Width of each range. Length of each range. Height of each range. Number of rows of shelves in the height. Color of finish desired. It should also be stated whether or not it is proposed to add an upper tier of stack with a deck floor over the first tier some time in the future.

For stacks of more than one tier in height, added information concerning the number of tiers, dimensions of the deck floors, position of stairs, gallery railings, window guards, etc., is needed.

Where ranges are to fit against a wall, a detail should be furnished showing any projections from the wall, i. e., base boards, chair rails, etc., so that, if possible, the uprights may be notched around the same. See Fig. 36, page 34. Mention should be made of the trim around windows and doors and of any radiators or steam pipes which might interfere with the stack.

Although stacks are built to order, there are established manufacturing standards, patterns and dies, to which it is necessary to conform for the sake of economy. Special construction, designs or sizes are expensive. It is well in stating requirements to mention those features which are essential and those which are merely preferred and therefore subject to modification. In other words, give as much freedom as possible for the development of the stack according to the spirit rather than the letter of the requirements. Such latitude tends toward economy and toward rendering the finished result more satisfactory to the user.

TIER HEIGHTS

ONE of the basic principles of the modern bookstack is to have every shelf accessible, without the use of steps or ladders, to a person of average height. The old arrangement of running shelving to the ceiling without a gallery is looked upon with disfavor. A mezzanine floor or gallery, although adding to the cost, is more practicable and economical in the end. Such a floor, however, is not feasible where the ceiling is less than 12½ feet or 13 feet high.

The regular stack tier heights are 7 feet or 7 feet 6 inches. These may be modified if necessary, but if 7 feet 6 inches is exceeded by more than 2 inches modification is liable to cause a considerable additional expense. Moreover, there is waste space in tiers that exceed 7 feet 6 inches, as the upper rows of shelves are inaccessible. The height of the bottom tier can be increased a few inches by increasing the height of the stools supporting the uprights under the bottom fixed shelves. These are ordinarily 2 inches above the floor.

In planning a library it is advisable to have the distance between the main floors of the building multiples of the stack tier heights, so that as many as possible of the stack floors will be on a level with the main floors. This greatly increases the convenience of access to the stack and allows book trucks to be moved without hindrance from the stack room to other parts of the building. See section of New York Public Library on page 114 and section of Library of Congress on page 136.

Fig. 108 STACK ROOM, DENVER PUBLIC LIBRARY

STACK ENGINEERING

THE various engineering requirements which may arise in the construction of a building, such as the supporting of floors and roofs and the bracing of walls, are easily fulfilled by the Library of Congress stack construction. Ordinarily the stack is a self supporting structure surrounded by masonry walls. It is customary to reinforce the walls by tying them, at intervals of about 7 feet, with the stack deck floors. This also serves to steady the stack tiers and renders diagonal bracing within the stack unnecessary. However, when diagonal bracing is used, the stack can be made an entirely independent structure and may support curtain walls enclosing it.

The rows of stack uprights, generally about 3 feet on centers in one direction, 4 feet or 5 feet in the other, and thoroughly braced about every 7 feet in their height by the deck floors, can easily be made to carry heavy superimposed loads. The two-tier basement stacks in the Brookline, Mass., Somerville, Mass., and Gary, Ind., Public Libraries and the stack in the Library of Hawaii, carry floors above. The two-tier stack at Whitinsville, Mass., and the three-tier stack of the Coburn Free Library, Owego, N. Y., support their own roofs. In the Elizabeth, N. J., Public Library the medical reference room in the second story rests on the four-tier bookstack below. In all the above buildings the stack uprights, each consisting of a single through casting with central stiffening ribs required no extra reinforcement.

The castings are so designed that shelf supports for even a one-tier or two-tier stack are generally strong enough for use in the bottom of a seven-tier stack. This permits of the shelves being made the same size and interchangeable throughout, and sometimes has other advantages. For instance, a two-tier stack in the old Indiana State Normal School Library was reset in the new building and two tiers added above with plans for still another. Such use was in no way contemplated when the stack was built, but the extra strength was the means of saving several thousand dollars.

Fig. 109. GORE HALL, HARVARD UNIVERSITY LIBRARY, CAMBRIDGE, MASS.
Structure in course of demolition, winter 1913, to make room for the Widener Memorial Library. Note that stack structure is entirely independent of the surrounding walls.
Stack illustrated was not supplied by The Snead & Co. Iron Works

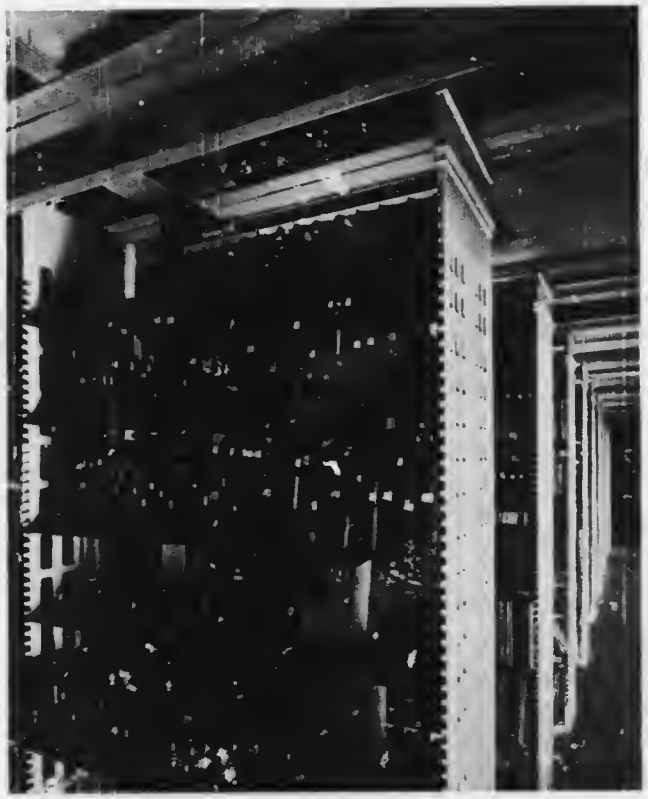


Fig. 110. UNIVERSITY OF MICHIGAN LIBRARY, ANN ARBOR, MICH.

Two-tier stack suspended from steel roof trusses. Stack ranges 5'-0" on centers. Roof trusses 10'-0" on centers

Fig. 111 BROOKLINE PUBLIC LIBRARY, BROOKLINE, MASS

Second tier of basement stack room showing method of carrying reinforced concrete floor of reading room.

As a rule when stacks are unusually high, or the superimposed loads excessive, the stack uprights consist of central structural steel columns with flat cast iron shelf supports attached in each tier. The columns are in multiple tier lengths, breaking joints at the deck floors and securely braced by the deck framing. The accompanying sketches, Figs. 112-a and 112-b, show how the strength of these columns can be increased indefinitely, without encroaching on book space, by simply lengthening the arms of the columns. In a twenty-tier stack the ends of the rectangular shelves need not be more than $\frac{1}{2}$ inch apart and their back edges $\frac{3}{4}$ inch apart; thus no available book space is occupied by the structural work. In the Library of Congress there are four nine-tier stacks with these structural steel columns. One of these, the new southeast court newspaper stack, carries above it a work room and over that, its own roof. The main stack room of the New York Public Library is seven tiers high and supports the floor of the great reading room. The new Widener Memorial Library of Harvard University has a ten-tier stack carrying a floor of seminar and lecture rooms.

Fig. 112-a Range Front

Fig. 112-b Partition

SECTION THROUGH UPRIGHTS

Showing flat cast iron shelf supports attached to central structural steel columns

A floor carried on a stack can be made unusually thin as the points of support are close together. A construction is frequently employed having 3 inch I beams running along the top of each stack range, either underneath or imbedded in a reinforced concrete slab 3 inches to 6 inches thick. Allowing 2 inches for the finish above the slab, the total thickness of the floor need be only 5 inches to 8 inches, thus affording a great saving in space and floor material. Although stacks are well adapted for carrying uniformly distributed loads, they are not so well fitted for the heavy concentrated loads of masonry walls or columns within a reading room. If necessary these columns and walls can be provided for in the stack structure but it is usually less expensive to continue heavy columns down through the stack.

The original stack in the University of Michigan Library, of the Gore Hall type, carried a museum floor above. To increase the stack space plans were made to build a two-tier stack in the museum room. The stack below was not strong enough, however, to carry the increased load. There was then, no alternative but to suspend the new stack. New steel roof trusses were placed across the room parallel to the old wooden trusses, which remained in place. From the steel trusses steel bar suspenders were dropped at intervals of 4 feet to 6 feet and to their lower ends were bolted pairs

Fig. 113. COBURN FREE LIBRARY, OWEGO, N. Y.

Sloping roof of stack room carried by cast iron struts on top of third tier shelf supports. Tops of these shelf supports are tied together by two steel angles instead of flanged cover plate.

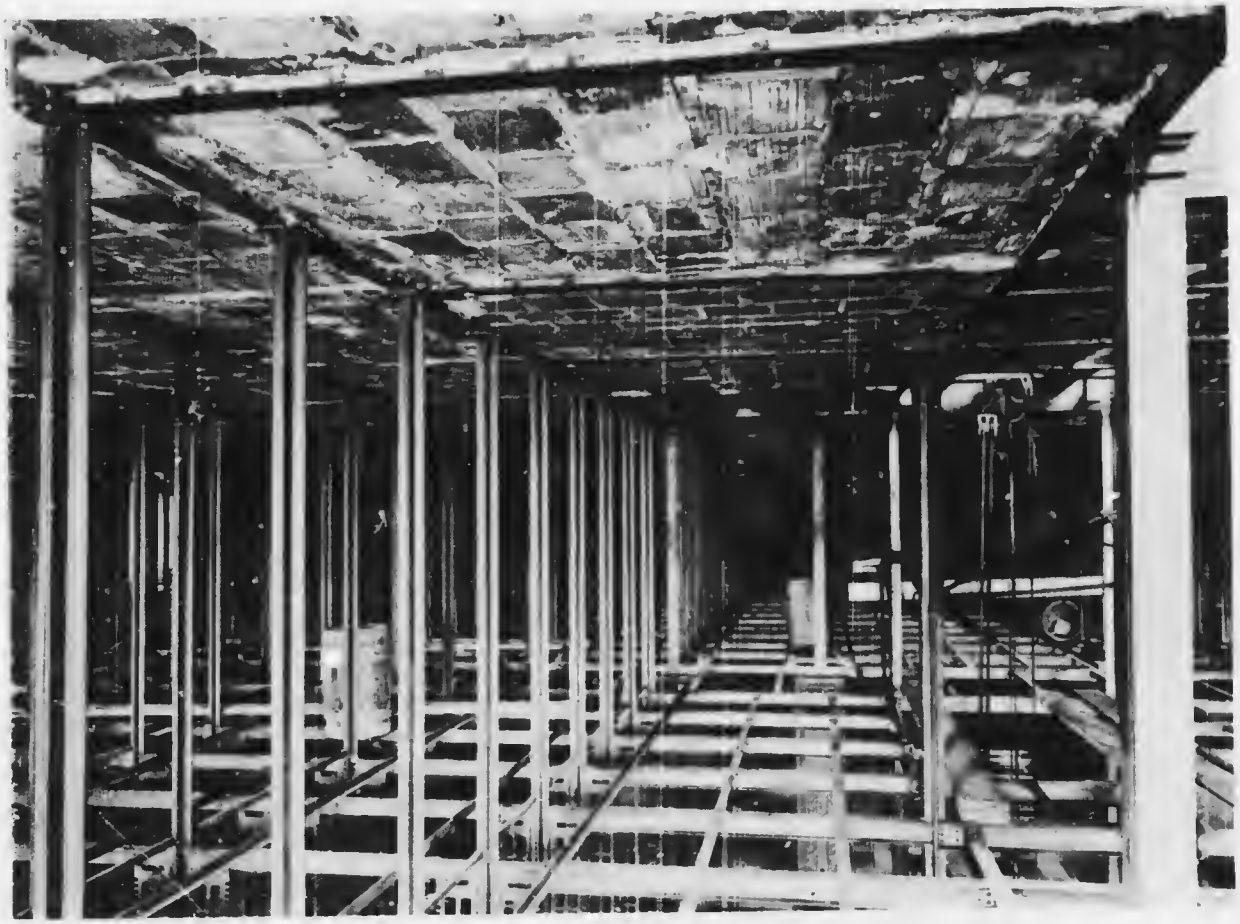


Fig. 111 SEVENTH TIER OF MAIN STACK ROOM, NEW YORK PUBLIC LIBRARY, DURING CONSTRUCTION

View showing steel framework of stack, supporting floor of main reading room above. See Fig. 117 for view in seventh tier after completion

of steel channels just clearing the floor. There was one pair of channels for each range and they were entirely concealed by the bottom fixed shelves and base of the end shelf supports. On top of these channels the two tier stack with its marble mezzanine floor was built, and over the stack a reinforced concrete slab was constructed to isolate the old wooden roof and eliminate fire risk. See Fig. 110, on page 76.

In the Bibliotheque St-Sulpice at Montreal, the librarian's office and cataloging room are built directly in the stack room, with book ranges above, below and to one side. See main floor plan on page 199 and transverse section on page 200.

The stack room of the Widener Memorial Library, see plan on page 155, has been constructed with study rooms incorpocated in the stack work, and also with rows of reading alcoves placed along the outside walls.

Both in new buildings and in alterations, interesting engineering problems frequently arise in connection with the bookstack. If taken up at the outset with the stack manufacturer, a solution can usually be found that is safe, simple and economical in space and construction.

Fig. 115. MAIN STACK ROOM, NEW YORK PUBLIC LIBRARY

View in center of seventh tier, showing stack columns supporting steel beams and terra cotta arch floor of main reading room overhead. Heating and ventilating duct in left foreground. See Fig. 114 for view in seventh tier during construction.

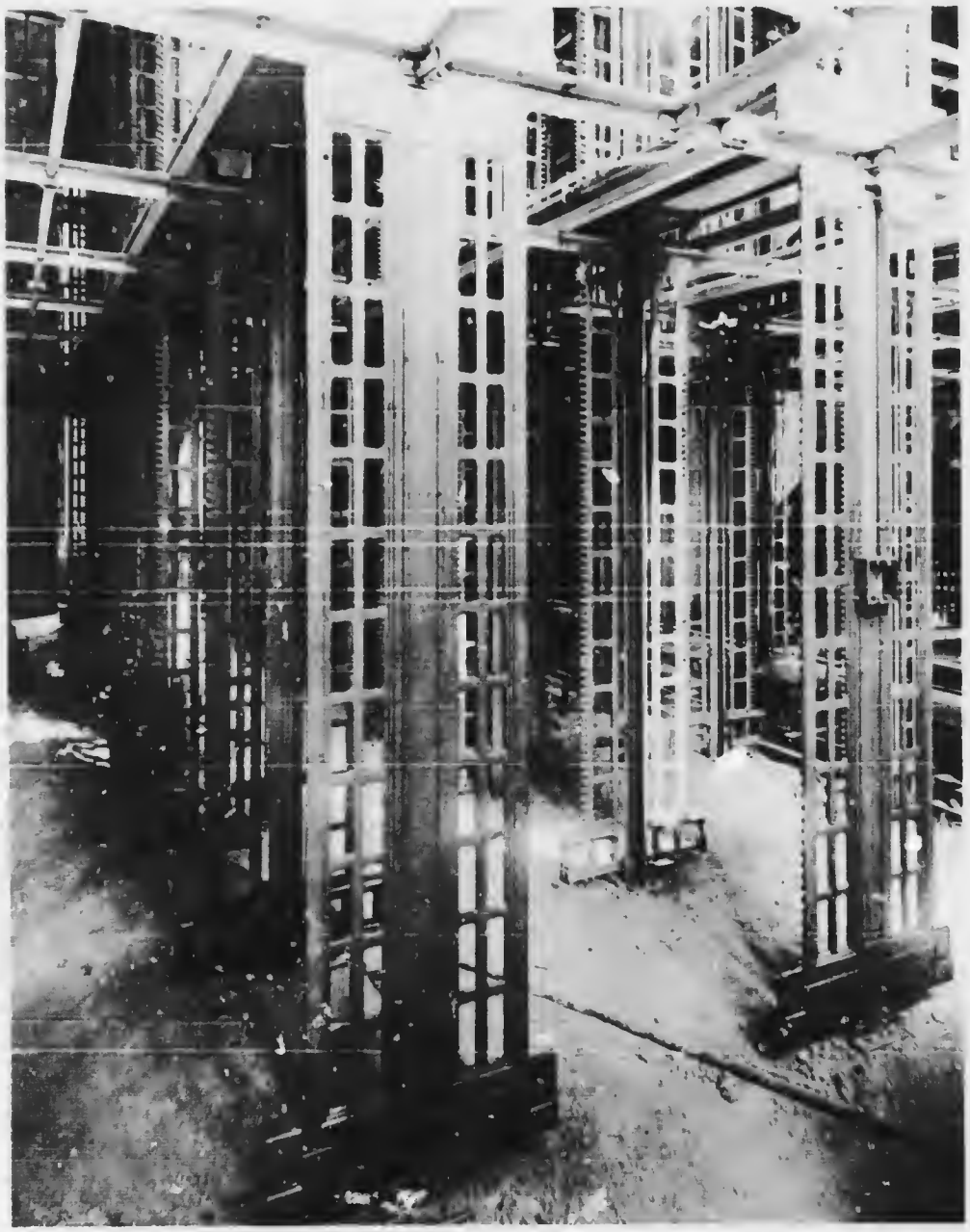


Fig. 116. HARRY ELKINS WIDENER MEMORIAL LIBRARY, HARVARD UNIVERSITY, CAMBRIDGE, MASS.

Construction view showing portion of fifth stack tier carried by girders over ground story reading room. The lower part of the shelf supports are extended into the aisles to carry wide fixed bottom shelves.

FOUNDATIONS

STACK foundations are provided, as a rule, by laying a concrete slab over the whole stack room floor, of such thickness or so reinforced that it will carry the loads without cracking. Economy is sometimes gained by making the floor thin and having a concrete beam under each row of stack columns to form a continuous footing. It is impractical to put a separate footing under each column as the latter occur at such close intervals (about 3 feet in one direction and 4 feet in the other) that the footings run together. The floor and lower walls should be thoroughly damp-proofed so that the first tier will be dry enough for books.

When the soil under a building is of such a nature that settlement is liable to occur, the area of the footings under the walls and of those under the stack should be so proportioned that the pressure on the ground will be everywhere equal, thus causing uniform settlement. On this account it may be necessary to use the beam footing construction, with the concrete slabs between not bearing directly on the ground. This distributes the stack loads over a small area and equalizes the pressure under the stack and wall footings. In cold weather all footings should be protected from freezing; otherwise the floor may heave up in places and push the shelf supports out of true, not only with each other but also with the surrounding walls.

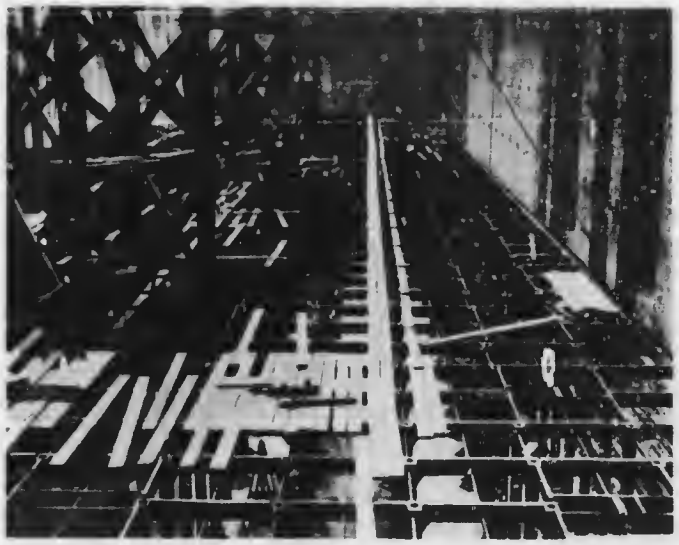


Fig. 117 NEW YORK PUBLIC LIBRARY

Construction view, September 1, 1905, in main stack room, showing cast iron columns in cellar which carry the seven tier bookstack. Note cast iron brackets built into the wall for the attachment of stack deck floors. Such brackets are not recommended as they require the greatest care in setting to insure their being in exact position

If an air space is desired under the stack room floor it is good construction, although expensive, to have walls or rows of piers with brick arches between them in the cellar under the stack ranges. Where there is to be a basement under a stack room, two methods of construction are available. The first and most economical is to continue the stack columns down to the basement floor and to make the floor above of light construction similar to a regular stack deck, but without deck shfts. The second is to use larger structural columns under every second or third stack

Fig. 158 OHIO STATE UNIVERSITY LIBRARY, COLUMBUS, O.

View showing steel decks 8' 6" high [illegible] support the [illegible] Columns are provided with holes for the attachment of the future shelf supports in the basement [illegible]

upright (or possibly at greater intervals) and to construct a heavy grillage on top with a beam upon which each row of stack uprights may rest. This gives more space in the basement for mechanical equipment or working purposes than the first method, but the space cannot readily be used for book storage. The cellar columns should be fire proofed unless it is certain that the space will not be used for the storage of inflammable material such as empty boxes, waste paper, furniture, etc. These might endanger the stack structure in a way not possible with books.

SNEAD METAL MUSEUM CASE, STYLE "O"

See also pages 89, 100 and 261

STACK WEIGHTS

ALTHOUGH the dead loads of stack construction vary with each stack installation, they can be accurately determined; the weight of the books and the live load on the stack decks must be assumed. The proper allowance for deck live load differs with each building, 70 lbs. per square foot is frequently used for a stack of but a few tiers to make sure that the deck framing will be amply stiff to prevent deflection and vibration. However, it is out of the question to consider that any such live load could ever come on all the decks. Therefore, the assumed live load may be greatly reduced when calculating the strength of the columns and might be disregarded entirely so far as the foundations of the stack are concerned. A conservative basis of calculation is to assume a live load of 40 lbs. per square foot for the top deck and reduce the amount 10 per cent. for each tier below.

Unit weights given below are a safe average for an ordinary bookstack:

Shelf supports and shelves	6 to 10	lbs. per cubic foot of range.
Books	20	" " " " " "
Deck framing	4	" " square foot of gross deck area.
$\frac{3}{4}$ inch glass flooring	10	" " " " " net area.
$1\frac{1}{4}$ " marble flooring	18	" " " " " " "
Live load	40	" " " " of glass or marble area of top tier, and reduce the amount 10 per cent. for each tier below.

When a stack must be erected on a floor of light construction, there is sometimes a prejudice in favor of the use of a bracket stack rather than a standard stack. This prejudice, however, is not well founded since the difference in weight between the lightest kind of a bracket stack and a substantial standard stack is almost negligible when proper account is made of the weight of books, deck floors, deck framing and live load on floors. In either case, the weight of the last four items should be the same. The shelf supports, or uprights, of the bracket stack are lighter than those of the standard stack, but the shelves themselves are heavier, so that the net difference in weight is but a small proportion of the total weight of the stack construction. In fact, after making proper allowance for the weight of books and the live load on decks, the total weight on the floor with a bracket stack might be as much as $1\frac{1}{2}$ per cent. less than with a standard stack, but is more likely to be only 1 or 2 per cent. or even nothing.

The books themselves are the principal factor to be considered in reference to floor loading, as they are far heavier than the shelf supports and shelves, and the variation in their weight is much greater than the variation in weight of the different types of stack.

The following plans and unit weights are given to show two extreme cases and a medium example. It is unlikely that the combination of extremely heavy weights in the last example could ever be obtained in an actual bookstack, but it serves to illustrate the maximum limit of weight.

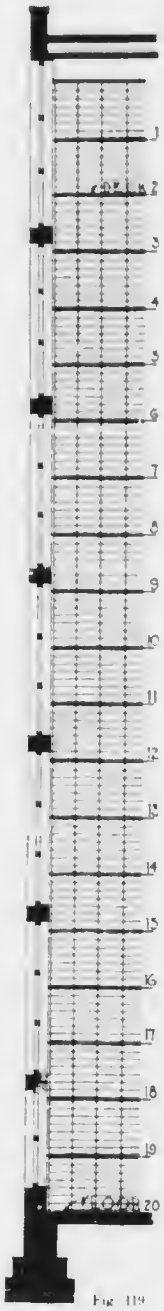


Fig. 119

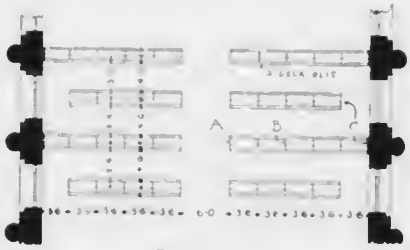
PLANS AND UNIT WEIGHTS

These plans and unit weights are assumed to show examples of light, medium and heavy stack construction.

Computations on opposite page.

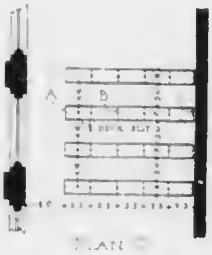
UNIT WEIGHTS

	Light used with Plan N	Medium used with Plan O	Heavy used with Plan P
Stack construction	7 lbs. per cu. ft.	8 lbs. per cu. ft.	11 lbs. per cu. ft.
Floor framing	4 lbs. per sq. ft.	6 lbs. per sq. ft.	5 lbs. per sq. ft.
Deck flooring	¾" glass, 10 lbs. per sq. ft.	1" marble, 18 lbs. per sq. ft.	1" slate, 20 lbs. per sq. ft.
Books	20 lbs. per cu. ft.	25 lbs. per cu. ft.	30 lbs. per cu. ft.
Live load	20 lbs. per sq. ft.	40 lbs. per sq. ft. decreased 10% for each tier	70 lbs. per sq. ft.
Tier height	6' 0"	7' 0"	7' 6"



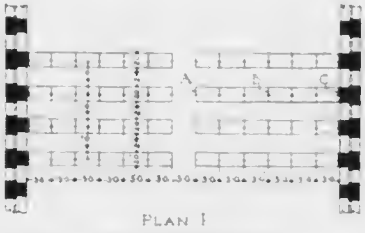
PLAN N

Fig. 120 LIGHT CONSTRUCTION



PLAN O

Fig. 121 MEDIUM CONSTRUCTION



PLAN P

Fig. 122 HEAVY CONSTRUCTION

NOTE (FOR NEXT PAGE). In calculating W for plan O, the width of the stack room was measured from the blank wall to the middle of the main aisle. The framing, flooring and live load for the other half of the main aisle are carried by the outside wall.

TABLES OF BOOKSTACK WEIGHTS

Examples of light, medium and heavy stack construction according to conditions of plans and weights on opposite page. The figures given show the weights in pounds at the foot of each typical stack shelf support; also the weights per square foot on stack room floor, for any number of stack tiers and deck floors from one to twenty.

This table merely illustrates the general variation of stack weights; detailed calculations should be made whenever actual construction is undertaken.

A = Weight at typical aisle end shelf support
B = Weight at typical intermediate shelf support
C = Weight at typical wall end shelf support.
W = Weight per square foot on stack room floor

		PLAN N (Using light unit weights)				PLAN O (Using medium unit weights)				PLAN P (Using heavy unit weights)			
Tiers	Decks	A	B	C	W	A	B	C	W	A	B	C	W
1	0	411	882	411	36	581	1165	583	99	769	1538	769	118
2	1	1622	2188	1401	98	2152	2910	1155	181	2153	3765	1883	297
3	2	2863	3493	2367	159	3658	4617	2909	290	4137	5893	2997	476
4	3	3983	4799	3430	220	5102	6289	4111	396	5821	8221	4111	651
5	4	5161	6104	4293	282	6482	7925	5062	499	7505	10449	5225	833
6	5	6345	7410	5256	343	7800	9525	6762	600	9189	12676	6339	1012
7	6	7526	8715	6219	405	9051	11090	5541	699	10873	14901	7453	1190
8	7	8707	10021	7182	466	10246	12618	6309	791	12557	17131	8567	1369
9	8	9887	11326	8145	528	11375	14111	7055	887	14241	19359	9681	1548
10	9	11068	12632	9108	589	12441	15570	7781	978	15925	21586	10797	1726
11	10	12249	13937	10071	650	13411	16991	8491	1066	17609	23811	11909	1905
12	11	13430	15243	11034	712	14385	18377	9187	1151	19293	26011	13023	2081
13	12	14611	16548	11997	773	15325	19762	9880	1236	20977	28209	14137	2262
14	13	15791	17854	12960	835	16265	21148	10573	1321	22661	30406	15251	2441
15	14	16972	19159	13923	896	17206	22531	11266	1406	24345	32721	16365	2620
16	15	18153	20465	14886	958	18146	23920	11958	1491	26029	34951	17479	2798
17	16	19334	21770	15849	1019	19086	25305	12651	1576	27713	37179	18593	2977
18	17	20515	23076	16812	1080	20026	26691	13344	1661	29397	39406	19707	3156
19	18	21695	24381	17775	1142	20967	28077	14037	1746	31081	41634	20821	3334
20	19	22876	25687	18738	1203	21907	29462	14730	1831	32765	43861	21935	3513

EXAMPLES OF THE USE OF THE TABLES

The weight on the bottom floor of a stack room 7 tiers high, including of course 6 stack decks, is, in the "light" example, 7526 lbs. under each shelf support A, 8715 lbs. under each shelf support B and 6219 lbs. under each shelf support C, or a total of 405 lbs. per square foot over the total area of the stack room floor.

Should it be desired to install a two-tier stack (with one deck floor) of "medium" weight, the table shows that the stack room floor would have to be capable of carrying 181 lbs. per square foot, in addition to the live load calculated for the floor and that the concentrated loads under each shelf support would be: at A, 2152 lbs., at B, 2910 lbs. and at C, 1155 lbs.

STACK ROOM WALLS

IT is important to have stack room walls square, straight, plumb and free from projections, as the building of a book stack to conform to small irregularities is impractical. The stack must be kept within minimum dimensions, even though the space outside these dimensions be wasted. All mouldings and projecting trim should be eliminated as they hinder a close fit. A beam projecting from a wall where there are to be wall ranges is most objectionable because it necessitates the ranges being built out far enough to clear. The uprights cannot well be notched around, since their strength depends on continuous flanges along the back edges. Placing the ranges in front of the beam leaves an opening behind, which must be protected by steel plate or wire mesh backing to prevent books falling through. Wall ranges should be set close against the walls so that metal range backs are unnecessary as the pockets formed behind are both space wasting and insanitary.

Stack deck floors are usually connected to adjoining masonry walls at intervals of from 6 feet to 8 feet, in order to tie together and brace both the building and stack and to provide a partial support for the wall aisles so that they will not have to be cantilevered out from the shelf supports. As a rule the curb angles bordering the deck floors clear the walls one inch or two inches to provide for irregularities and ventilation. The floor connections are best made after the walls are finished. This is done by means of cast iron brackets expansion bolted into place. Repeated experience has proved the difficulty of depending on the masons setting anchors in the right positions. If anchors must be built in, they should be specially designed so that small irregularities of position can be overcome when the stack work is connected.

It is hardly necessary to say that all outside walls should be furred or insulated so as to keep dampness away from the books. Common brick painted white does not make a bad facing for the interior walls of a storage stack. White plaster is better. Next comes light colored face brick and, best of all, white enameled brick. Plaster is usually put on before the stack is set, because of the difficulty in working around deck floors and uprights.

NATURAL LIGHTING

IN large storage stacks natural light is not necessary and it is often advisable to assign all outside rooms to other purposes. However, in small libraries it is unlikely that artificial light will ever entirely supersede daylight. Where daylight is to be depended upon, a larger window area is required than for ordinary rooms whose interiors are not packed full of books and stack construction.

From an aesthetic point of view, the design of the windows in a stack room is frequently a difficult problem. A stack naturally requires a window at the end of every aisle in each tier, but the outside appearance of such an arrangement is inharmonious with the architectural treatment of most buildings. Consequently, long slit windows have been adopted with such success that they have come to be considered the typical stack window. They more truly represent their purpose than rows of small windows as they indicate that the interior behind them is one large room. Furthermore they may be worked into the exterior design in a way that is both interesting and attractive, as shown in Fig. 123.

In the New York Public Library the centers of the piers are opposite every other range, while in the Widener Library they are opposite every third range. In both instances there is

Fig. 123. REAR VIEW OF NEW YORK PUBLIC LIBRARY, SHOWING LONG SLIT WINDOWS OF STACK ROOM BELOW THE LARGE WINDOWS OF THE MAIN READING ROOM

direct light for each stack aisle. See Figs. 117 and 160. The masonry piers can be stiffened if necessary by heavy metal ties running across the windows at the deck levels or about 3 feet above, where they will not cast objectionable shadows. The outside reveal of the windows may be made as shallow as desired to give room for a folding or stationary ledge inside, a matter of great convenience for work in the stack. In a narrow stack room it is permissible to have the ends of the ranges opposite the windows if the uprights are of open construction with a light finish and wide side aisles. This allows the light to hit at a good angle for illaminating titles.

The position of windows is rather more important than their size since the most valuable light comes from the glass nearest the ceiling. The highest light is effective for the greatest distance from the windows and roughly speaking half the illumination comes from the upper third of glass area. For this reason windows but one tier high can be made nearly as efficient as slit windows, if their tops are placed a little above the deck floor of the tier overhead so that the highest rays are unobstructed. See transverse section of Library of Congress stack on page 15.

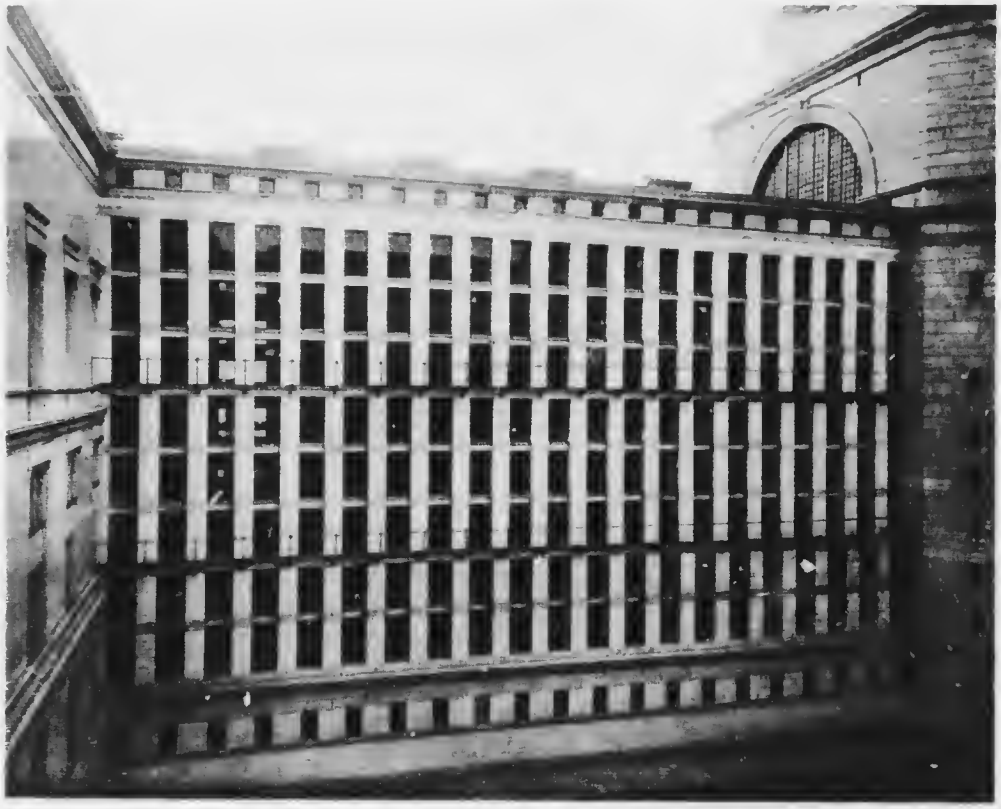


Fig. 121 VIEW IN NORTHWEST COURT, LIBRARY OF CONGRESS, SHOWING WINDOWS OF NORTH STACK ROOM

Prism glass with ribs arranged to throw the light rays horizontally across the stack tiers is of assistance in illuminating deep rooms. Open work shelf supports, a white finish on the stack construction and walls, white marble floors and deck slits are valuable for making the available light go as far as possible. Light rays pass freely through the openings or else are reflected from the white surfaces. In a stack so designed the books themselves form the principal obstruction to light.

SNEAD METAL MUSEUM CASE, STYLE "D"
See also pages 82, 100 and 261.

Fig. 125 AMERICAN GEOGRAPHICAL SOCIETY
NEW YORK CITY

Looking down center aisle, showing tassel switches for electric lights at ends of range aisles. Range fronts of classic design with special monogram. Skylight above gives light through glass deck floors.

Fig. 126 LIBRARY OF CONGRESS
WASHINGTON, D. C.

View in center aisle of east stack. "Timelimit" switches on alternate end shelf supports. Had the switches been installed at the outset, covered ducts as shown in Fig. 128 could have been provided instead of exposed conduits.

ARTIFICIAL LIGHTING

THE artificial lighting of modern stack rooms is now accomplished solely by means of electricity which, if properly installed, is entirely safe. Gas has been found inconvenient and costly and in some of the old libraries it was discovered that the bindings and the leaves of books shelved near the ceiling were rapidly being destroyed by its fumes.

Tungsten lamps, because of their economy in the consumption of current, are preferred to the old style of carbon lamps. Lock sockets should be provided in open stack rooms.

There is much room for improvement in stack lighting systems. As a rule the upper shelves are brightly illuminated, while the titles of books on the lower shelves are read with difficulty. The use of opalescent glass shades of proper curvature, aids in lighting up the bottom row of books and protects the eye from the intense glare from the bare filaments, but the distribution of light which they give is not uniform. Special reflectors are made which distribute the light rays equally over the whole face of a range, but they greatly increase the cost of the lighting installation. Indirect lighting is not generally practicable as it requires too great a consumption of current. White marble deck floors do much to distribute light for they not only reflect the rays upwards but diffuse them by reflection from the under side of the floor above. Where glass floors are used, arrangements are sometimes made to control the lights of the tier below so that they will shine up through the floor and illuminate the lower shelves. This method although formerly popular, is now seldom used in new buildings as it complicates the wiring and is costly to install.

Fig 127. ST CHARLES THEOLOGICAL SEMINARY, OVERBROOK, PA

View showing electric lights controlled by chain pulls. Conduits carried by stack cover plates. When second tier is added, conduits can be raised to new level by merely disconnecting them at the walls.

The choice of a method for controlling the lights of a stack room should be determined by the conditions of use. Small libraries ordinarily have one main switch board controlling all lights in the stack, with chain pulls for individual lights. This arrangement saves in current and is the least costly to install. It also allows the

Fig. 128. ELIZABETH, N. J., PUBLIC LIBRARY

Double push button switches on alternate end shelf supports. Construction is finished with air-drying enamel to harmonize with the blue-white marble deck floors.

Fig. 129. HARPER MEMORIAL LIBRARY, UNIVERSITY OF CHICAGO

Second tier of underground, basement stack. The aisle lights are controlled by raising the bars connecting the end shelf supports. This prevents lights being burned when aisles are not in use.

conduits to be run perpendicular to the ranges, so that they are supported by the cover plates over a single tier or over the top of a stack of several tiers.

The most widely used method of electric light control is to have double push-button switches on alternate end shelf supports for the lights in each stack aisle. With double switches it is evident at a glance that the lights in any aisle are controlled by the switch nearest at hand. Sometimes switches are placed on the opposite ends of the same range, for the convenience of the attendant, who enters at one end of the aisle and leaves at the other. End switches are also employed where the utilization of the lights below a glass floor is desired.

Occasionally, tassel switches are used at the aisle entrance. These cost less than end switches and are sometimes necessary where a special design of end shelf support interferes with the fixed switch box.

In some of the largest stack rooms, gang switches are placed at convenient points to illuminate large sections at a time, the theory being that lights are more likely to be turned off at one switch than at several. This method is used in the New York Public Library and was in use in the Library of Congress until supplanted by "time limit" switches.

These "time limit" switches are operated by means of clock-work running in oil and are customarily placed on alternate end shelf supports along the main aisle. As an attendant enters an aisle to get a book he pushes the nearest switch. He then has to pay no further attention to the lights as they go out automatically after the lapse of a fixed period of a few minutes. They can be kept burning indefinitely, however, by inserting a special key in the switch. Although the price of these switches is from ten to fifteen dollars each, it is estimated that in the Library of Congress they have halved the consumption of current and globes As they come into use more generally their cost will undoubtedly be decreased. They will not be recommended, however, by readers who like to browse.

In the Harper Memorial Library of the University of Chicago, the lights in each aisle are controlled by means of a hinged bar extending across the entrance. When entering the aisle, the bar is lifted and the lights are automatically turned on. They are switched off again when the bar is raised at departure. See Fig. 129.

The spacing of the lights varies with conditions, but the general rule is to place 16 candle power carbon lamps or 25 Watt tungsten lamps about 6 feet apart in range aisles and from 12 feet to 24 feet in the main aisles where the lights are in constant use. Occasionally a portable bulb, protected by a wire screen and mounted on a handle attached to an extension cord, is used. These portable lights are found convenient for searching lower shelves.

Electric wires should always be protected by metal conduits and ducts. These conduits should be designed to have the wires accessible for repairs. If the wires are protected by metal and the current supply properly fused, there is no danger of fire from a short circuit. . . . The electric wiring of a stack room is usually a sub-contract with the stack manufacturer. However, it is best placed under his control, so that the stack work can be properly prepared to receive the conduits and switches. The appearance and convenience of many stack rooms have been injured by not considering the lighting question until after the stacks were installed.

HEATING AND VENTILATING

MANY different methods for heating and ventilating stack rooms have been attempted, but none have proved more satisfactory than the system installed in the Library of Congress stacks. See sections of Library of Congress, pages 14 and 15. This system will work either in conjunction with the heating arrangements or independently of them as the weather requires.

The Library of Congress stacks have fresh air intakes leading into the basement from interior courts covered with grass, and practically free from dust. By means of electric fans the air is first drawn through closely woven wire mesh screens to eliminate the larger foreign bodies. It is then thoroughly filtered for the removal of dust and may be washed with water sprays, although this precaution is seldom found necessary. From the filters, the air passes through the heating chambers, where radiators heat it to any temperature desired. From here, under the pressure of the fans and its own natural tendency to rise when warmed, the air flows into the stack room and up through the stack structure. The deck slits along the faces of the ranges and around the walls permit an equitable distribution of the fresh air. In cold weather the difference between the temperature of the air outside and that within the stack room is sufficient to cause a continuous outward flow through louvres in monitors on the roof. In warm weather exhaust fans, mounted in the monitors, supplement those in the basement and help to keep the air circulating. The system is rendered fully efficient by the fact that all the stack room windows are hermetically sealed. Sealed windows also aid considerably in eliminating the dust. One of the great advantages of this system is that there are no hot pipes in the stack room to occupy valuable space and injure adjacent books. Nor do the upper tiers tend to become over-heated as is the case with the direct system of heating from radiators.

In the stack rooms of small libraries where an indirect heating system is impracticable, the mistake should not be made of distributing radiators or pipe coils uniformly through the height of the room. Such an arrangement makes the upper tiers unbearably hot when the lower ones are only comfortably warm. As the warm air is free to rise through deck slits and stair wells the space occupied by the stack should be treated as one room and not as a series of low stories.

Proper atmospheric conditions are of prime importance for the preservation of books. The following are a few simple rules to follow:

1. Do not overheat the stack room. From 60 degrees to 70 degrees is a good range of temperature.

2. Avoid dampness and unnatural gases in the atmosphere.

3. Demand cleanliness in the handling of the books both within and without the library.

4. Books should be kept in clean open places where they have the benefit of good ventilation. Air should circulate freely around each volume to prevent disintegration. The

FIG. 140. EXAMPLE OF HAVOC WROUGHT BY INSECTS AT HILL MEMORIAL LIBRARY, BATON ROUGE, LA.

Previous to the installation of the new metal stack

late Dr. W. F. Poole said that books breathe just as do human beings and have practically the same requirements for fresh clean air.

Mr. William R. Reinick, in his article "Insects Destructive to Books," printed by the *American Journal of Pharmacy*, recommends good ventilation and the avoidance of insect breeding places. He says in part that:

"Late investigations have disclosed facts which show that insects are not only in search of the paste in bindings, but also of the cloths, woods, papers, inks, leathers, parchments, oils, etc., which go to make up the books.

"It has been stated that more books and papers are destroyed by small forms of life in one year than by fire and water combined; and, from the facts given by various writers and the statements made to me in letters by many librarians and others, especially where the libraries are located in warmer regions, I am positive that this statement is true.

"As far as the destruction of these insects by poisons is concerned, they are practically worthless, because whenever the poison is used to destroy one insect it will attract other insects who have need for this poison."

A stack which lends itself to thorough ventilation and is so constructed as to eliminate hollow, dust and filth collecting spaces, may be easily fumigated. Occasion for such action arose in January 1908 when one of the staff of the Washington Public Library was taken ill with smallpox. The building was promptly closed to the public and disinfected, where necessary, with formaldehyde. In the stack room the process was simple, owing to the fact that the building was equipped with a Snead Standard Stack. The ventilating slits in the decks, the open construction of the shelf supports and shelves, and the entire absence of hollow enclosed spaces allowed the formaldehyde fumes to penetrate everywhere.

Volumes which have been exposed to contagion should be fumigated individually. This may be done by the Beebe carbo-gasoline method. This consists of immersing the books in a solution of gas-machine gasoline containing two per cent. of phenol crystals. After twenty minutes they are removed and placed before an electric fan for two minutes and then stood on end for from twenty-four to forty-eight hours.

Another method of disinfecting consists of immersing the books in a solution of gasoline containing five per cent. of carbolic acid.

BOOKLIFTS, ELEVATORS AND OTHER STACK ACCESSORIES

HAND-POWER AND ELECTRIC BOOKLIFTS

THE satisfactory installation of a booklift depends largely upon the selection of that equipment which best meets the conditions and requirements of each case. There are two general classes of booklifts: hand-power and electric. Hand-power lifts are used in small libraries for short runs and light loads. Those required to carry one or two books at a time should be light and rapid running while those designed to carry loads of 100 to 200 lbs. or more should be strong and so geared that they operate with ease. When a small lift may sometimes be used for a few books and at other times for heavy loads, a compromise must be effected. One type of hand-power lift which has proved very satisfactory for high-speed services, consists of a pair of balanced trays, or one counterweighted tray, running between guides. These guides are preferably made of polished brass tubing or Kalamcined brass, to present a neat appearance. One of them may serve as a speaking tube to connect various floor levels, while the counterweights run within the other. The quick running of this type makes it useful for serving a delivery counter from a department above or below. A lift designed for heavy loads, however, must necessarily move slowly. The mechanical apparatus can be geared for any speed required but, when once set, cannot be readily changed. Booklifts are usually equipped with a device to make them self sustaining in any position of the run.

In large stacks it is generally advisable to install electric booklifts. These are usually built to carry from 100 to 300 lbs., at a speed of about 100 to 150 feet per minute. The hoisting machine can be located either at the top or at the bottom of the shaft. Generally it is preferable to have it in the basement in a small room or wire mesh enclosure alongside the shaft, where it can be readily cleaned by the janitor or engineer. Electric lifts are best controlled by

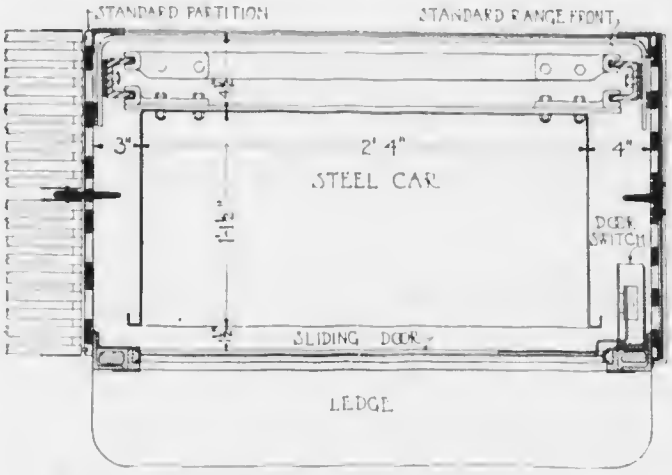


Fig. [illegible] a Plan of Booklift shaft running through the end compartments of a series of superimposed ranges

Fig. 131b. VIEW OF BOOKLIFT CAR AND STEEL PANEL ENCLOSURE, AKRON, OHIO, PUBLIC LIBRARY

The booklift travels through the end compartments of a series of superimposed ranges. For plan of a similar arrangement, see Fig. 131a, on opposite page. The enclosure is frequently made of panels of wire mesh similar to that forming the backing of the single-faced range alongside the stairway.

means of push-buttons arranged to meet different requirements of service. Safety devices render these push-buttons inoperative while any booklift door is open or while a car is in motion. The several systems of control are as follows:

One Point Control with Signals. With this system there is a central controlling station to which all messages must be sent and from which point the booklifts are operated. This control is efficient in a stack employing more than one lift.

Full Automatic Control. This consists of a full set of controller buttons, on each of the floors or decks, by means of which the car is called to or sent from the station.

Call Button Only. This system is used where telephones are installed in the stack room. It is similar to the Full Automatic Control except that the car can only be called to a station and cannot be sent to other points.

Cars are generally made of steel, 12 to 18 inches deep, 2 to 3 feet wide and 2 to 3 feet high. Removable shelves are convenient for handling books of various sizes.

At times a booklift is located outside the stack room, and opens into it, but almost invariably, it is placed directly in the stack room, where it is most accessible for the attendants. When installed within the stack it is generally included in the stack contract, since the stack manufacturer must provide the structural framing and enclosure for the lift shaft, the lift itself being supplied by a specialist. It frequently develops that the greatest convenience and compactness can be obtained by running the lift as shown in Figs. 131-a and 131-b.

ELECTRIC ELEVATORS

The most serviceable elevator for a stack room is one large enough to accommodate both passengers and book trucks. Push button control, consisting of a call button at the elevator door and a bank of push buttons inside the car, renders the services of an attendant unnecessary. Safety appliances, similar to those used with electric booklifts, are always provided. Electric elevators should only be used in large libraries and tall stacks as their installation forms a rather disproportionate expense for a small library.

BOOK CONVEYORS

Automatic book conveyors are designed to carry books both vertically and horizontally and perhaps from one building to another. Their action may be almost human in intelligence and in fact, mistakes are generally the fault of the operator and not of the conveyor. A description of the book conveyors in the Library of Congress will serve to explain the working of such appliances. See section of Library of Congress on page 14.

Conveyors in Stack. Each of these consists of a pair of parallel, endless sprocket chains, 20½ inches apart, driven continuously throughout the day, at a speed of 100 feet per minute, by means of a small electric motor. The chains run over sheaves of such size that the hanging trays pass freely over the axles wherever the direction is changed. Eighteen book trays are suspended from the chains at equal intervals. These trays are made of aluminum, for lightness, with small fittings of brass and iron. The tray bottoms consist of horizontal sets of parallel brass fingers, five-eighths inch apart, attached at the back and turning up slightly in front to prevent the books from projecting over. The trays thus pass flatwise through similar sets of teeth, or toothed racks, located at the various stations. At deck stations two such racks are provided, one at the arriving and the other at the departing part of the chain, for the automatic delivery and taking on of books. In the reading room both racks are on the same side, one above the other, one sloping inward, the other outward. As a tray arrives at its delivery station its contents are combed off and slide into a softly padded box. The capacity of each tray is the equivalent of a quarto, 3½ inches thick. The automatic action of the trays is secured through a set of movable spurs or keys on the back, one for each station and one general key. When a book is taken on, a dial is set by hand by which the general key is withdrawn and the tray prevented from responding to any call until its load is discharged at the proper station.

Conveyor to Capitol. This consists of trolleys running between parallel rails and having attached to them carriers large enough to hold a bound newspaper volume or a leather pouch of similar size and shape, for small books and other matter. Each carrier consists of a set of deep parallel hooks similar to the hanging human hand with fingers turned upwards,

nearly to the top. They are hung like a pendulum and always travel in an upright position, their loads being taken on and removed by the carriers passing upwards or downwards through toothed racks. The conveyors are moved by means of small flexible, endless wire cables, of which there are three along the route: one in the library, one in the capitol and the third, connecting these two, in the tunnel between the two buildings. The cable in the central loop is driven faster than those in the buildings, thus increasing the speed of deliveries.

ENCLOSURES

Elevators, lifts, conveyors, etc., running through a stack require some form of enclosure. This is generally made of a steel frame with panels of steel plates, wire mesh or wire glass. Panels of flat wire, woven into a square mesh, are recommended since they give an attractive, light and open appearance. Steel plates while somewhat cheaper are not so satisfactory.

MEANS OF COMMUNICATION

Pneumatic Tubes are used in large libraries for transmitting messages between the delivery desk and the different stack levels. The system consists of metal tubing installed between the various points of communication, and cartridge shaped carriers, usually about two inches in diameter, which hold the message slips. A partial vacuum formed in the tubes in front of the carriers causes the atmospheric pressure to drive them to their destination. Their cost of installation and operation is prohibitive for a small library.

The Telautograph is a delicate electrical apparatus, with writing pad attachment, by means of which a fac-simile of any message written at the sending station is immediately reproduced at the receiving station. It is sometimes used instead of the pneumatic tube service.

Intercommunicating Telephones are used in large modern library buildings to connect the different departments with each other and the stack tiers with the delivery desk. Automatic telephones are now on the market which eliminate the necessity of a central exchange.

PNEUMATIC CLEANING

A pneumatic cleaning apparatus is a valuable accessory for any stack. By its use, dust is actually removed from books and floors instead of merely being stirred up to settle in another place. A stationary plant is quite unnecessary and costs considerably more to install and operate than a portable machine, as the latter has only short tube lines and consequently loses very little power in transmission. Furthermore, it need only be in operation while cleaning is actually being done. The portable machine can be attached either to the electric light sockets in the stack or to plugs specially provided at convenient points.

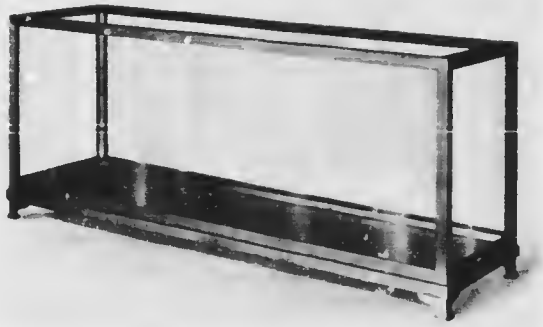
Probably the most efficient cleaning machine for a library stack room is a combination plenum and vacuum apparatus with two hose connections, one terminating in a hook shaped nozzle which serves as a blower, and the other terminating in a cone shaped bell at the apex of which is attached the vacuum tube. The operator works with blower in one hand and bell in the other. He passes the nozzle back along the tops of books or other dust covered surfaces and blows the dust forward in the direction of the bell. It is then drawn into the vacuum tube and filtered out by the machine. By this means, dust is driven from small crevices and corners which could not be reached by a regular vacuum cleaning apparatus.

UNDERGROUND BOOKSTACKS

LITTLE has been done as yet towards building bookstacks underground, except in so far as basement rooms of library buildings have been utilized. However, this method of storage becomes a necessity when adjacent space is required and architectural considerations or injury to light prevent an above ground addition. The expense of an underground stack is greater than that of a stack of corresponding capacity above ground, on account of excavating, heavy retaining walls, underpinning of adjacent buildings and administration solely with artificial lighting and ventilation.

As dampness is extremely injurious to books, the floor, roof and walls of the underground stack room should be thoroughly waterproofed. They should also be carefully insulated so that they will not be cold enough to condense the moisture in the air that touches them. A cork paint on all interior surfaces, where practicable, will prevent condensation although it cannot be wholly depended upon for insulation. Provision should also be made to prevent surface water draining into the stack during heavy rains or in times of fire in adjacent buildings.

In humid weather the temperature of the underground stack must be kept above that of the outside air, otherwise the increased pressure will force out the dissolved moisture and cause condensation on the metal work.



SNEAD BRONZE MUSEUM CASE, STYLE "P"

See also pages 82, 89 and 261

PARTIAL EQUIPMENT

IN planning a library building, sufficient stack space should be provided to accommodate growth for many years. It is often advisable to install only a part of the bookstack at the outset and to make future extensions as required. If there is no roofing or masonry work to be done, this proceedure is a simple matter and may be handled in several ways to meet various conditions of the general plan of the building.

1. The first tier or first few tiers of the stack may be installed at the beginning, with provision for the addition of future tiers above. In this case it is well to equip the uppermost tier with a portion of the framing for the deck next above so that the electric conduits

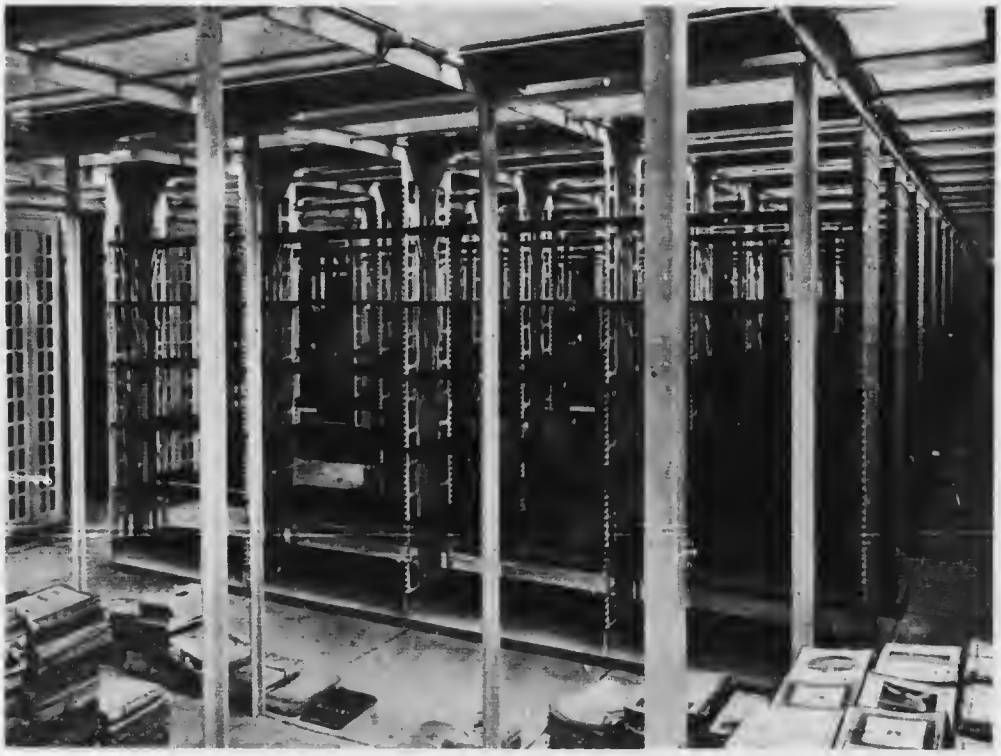


Fig. 132. BANGOR PUBLIC LIBRARY, BANGOR, ME.

View in basement tier showing bare structural steel columns partially equipped with shelf supports and shelves. The columns support the second tier which is on a level with the main floor of the building.

for this tier may be permanently supported by passing them through the steel floor members. If this is done, the electrical work will not have to be disturbed when the height of the stack is increased.

2. A portion of the stack room may be equipped with a stack of full height and future expansion effected by adding additional tiers of ranges, from time to time, to cover the balance of the available floor space. The overhang of the deck floors projecting beyond the stack ranges can be carried by temporary struts so arranged that they will not have to be removed until the new ranges take up the deck loads. The guard rails placed between these struts can be disconnected and reused each time an addition is made.

Fig. [illegible] BANGOR PUBLIC LIBRARY, BANGOR, ME.

View in second tier showing stack ready to receive the future second deck and third and fourth tiers. The top cover plates are provided with a removable steel cornice which can be reused on the future tiers above. Temporary bars support the electric conduits, which will later be suspended under the deck floor framing of the third tier, so that they will not have to be disturbed when the additional work is installed.

3. When a library is so planned that an upper tier of the book-stack is on a level with the main floor of the building, this tier, being needed most, should of course be installed first. This necessitates support from the tiers below but does not require the installation of full equipment. The initial cost of the stack can be reduced by supplying only the shelf supports and deck framing of the lower tiers and omitting the shelves and floor slabs. Or the combination cast iron and steel construction, page 26, may be used. In this case only the deck framing and central steel columns for the shelf supports need be supplied in the lower tiers as seen in Fig. 118, page 82, thus further reducing the initial expense. The stack may be extended either by attaching shelf supports to the steel columns or by building on more tiers above.

LIBRARY PLANNING

A SECTION DEVOTED TO SPECIAL ARTICLES ON THE PRINCIPLES INVOLVED IN THE PLANNING OF LIBRARY BUILDINGS

SOME ESSENTIALS OF LIBRARY DESIGN

By A. D. F. HAMLIN, A. M., L. H. D.

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THE public library is one of the most highly developed types of buildings to be found in American architectural practice. By careful study of the problems it presents, primarily by librarians and secondarily by architects, its requirements and the best means and devices for meeting them have been more completely worked out and standardized than those of any other type of edifice except the modern office building. Taken as a whole, the libraries of the United States, large and small, represent American architecture well-nigh at its best.

Library buildings may be broadly divided into two main classes, the large and the small, the difference between which is one not merely of size but also of function. To the first class belong all those in which the gathering under one roof of a variety of functions and services necessitates a special and complex plan for their accommodation; to the second, all such as by reason of simplicity of function and organization have simple plans and can be supervised by a very small staff. Thus it may happen that the single library which serves an entire town of moderate size may be smaller and simpler than a branch library in a large city.

All libraries are devices for bringing books and readers together. As such they comprise in all cases three fundamental elements: *First,* accommodations for the books; *Second,* accommodations for the readers; *Third,* accommodations for the staff – the active human agents in bringing books and readers together.

To these fundamental elements may be added any number of accessories, such as picture galleries, lecture rooms, club rooms, workshops for printing, binding and the like. But these are not in themselves essentials of a library building. The three classes of accommodations mentioned above are essentials and must be provided in every building however small. Such accessories as a heating plant, toilet rooms, stairs, vestibules etc., are of course included in any complete public building.

The art of library design is the art of providing the most perfect accommodations for each of the three above named requirements, *in such relation to each other that the books will be transferred from the shelf to the reader in the shortest possible time with the fewest steps and least labor both for readers and attendants.*

Before discussing the various means for accomplishing these ends, it is in order to set forth briefly a more detailed classification of library buildings with reference to the character of their service. Here again two main divisions appear: reference libraries, whose books are used only within the building; and circulating libraries, from which the reader may borrow books to be taken home. Practically all public libraries of this second class provide also for the use of books within the building, so that the combination of the two kinds of service does not constitute a third and distinct class. In such buildings the two classes of readers may be served, as in

the smaller libraries, from one central loan desk; or, as in the larger libraries, in different rooms, from different desks and by distinct sets of attendants.

Special subdivisions of these two classes are formed by the libraries of colleges or other learned institutions, professional organizations and other societies or clubs. In these the use of the library is restricted to certain privileged classes—the members of the institution, club or association; and in the case of professional and technical libraries, the books are confined to a more or less narrow range of subjects connected with the profession or science to which the library belongs. These restrictions give occasion for special arrangements not required or not practical in the generality of public libraries.

ACCOMMODATIONS FOR BOOKS

Taking up now in order the three essential factors of a library plan, we may remark that the storage of books may be on any one of three systems, or a combination of them: (*a*) the alcove system; (*b*) the open shelf system; (*c*) the stack system. By the first of these the greater portion of the area of a large room, on one or both sides, is divided into alcoves by book-cases projecting from the wall. The books are stored in these cases and on wall shelves, often in two or three stories forming galleries.

In the majority of public libraries, until the later years of the nineteenth century, the major part of the books were stored upon the shelves of alcoves two or three stories high, opening upon a lofty central hall or passage, as in the former Astor Library, New York, the Peabody Library in Baltimore, the Cincinnati Library (see page 13) and most of the famous Old World libraries. The second system is that which places the books within the immediate reach of all the readers, either in wall cases, or in wall cases and wing cases forming alcoves, usually shallow and limited to 7½ feet in height, so that all volumes are within arm's reach of an ordinary adult. By the third system the books are stored in bookstacks, forming tiers of shelves in stories not over 7½ feet high, set as close together as convenience will allow, in a wing or structure quite distinct from the reading rooms, though a part of the same building, and placed so as to be directly accessible from the loan desk or delivery room. It may be separated by fire-walls and fire-proof doors from the rest of the building; or, if the whole building be thoroughly fire-proof, it may form an open chamber or wing extending back from the main structure. The stacks are metal structures, independent of the walls of the buildings, and are usually designed and erected by concerns which make a specialty of their construction, upon specifications prepared by the architect, preferably with the technical advice and assistance of the stack manufacturer, to fit the structure he has designed. The system of storage in stacks, which has revolutionized American library design, was devised by Professor William R. Ware, to solve the problem of the enlargement of the Harvard College Library in 1876. In these stacks the shelves were of wood, but were carried by an iron framework standing independent of the walls from the cellar up, and supporting its own floors.

In the modern stacks the shelves are usually of metal. The stack system is of especial value where a large number of volumes must be stored in a restricted space, or kept together under the control of the library staff. The open shelf system—which has given rise to much controversy between those who believe that the loss of books due to free access of readers to shelves is more than offset by the advantages of such free access, and those who do not—is frequently made use of in particular reading rooms of libraries which at the same time store the greater part of their books in a stack room or stack wing. The alcove system has been generally abandoned since about 1890, because the projecting stacks or cases separating the alcoves cast wide shadows and cut off a large part of the room from the view of the attendant in charge. Where, however, the number of readers is small or restricted to certain definite classes, as in most libraries of colleges and clubs or societies, well-lighted alcoves may be advantageously provided, each alcove being devoted to one general department or category of books and made large enough to accommodate several readers at one table. Such alcoves form a series of quiet study rooms opening upon a central hall or corridor, each profiting by the spaciousness and airiness of the large room of which all are a part, while affording somewhat of the quiet and seclusion of a special study room. Modern examples of such a room are seen in the University Club and in the Avery Architectural Library of Columbia University, both in New York. For public libraries in general, however, the arrangement is wasteful of space and difficult of supervision. In the new Springfield, Mass., City Library (see pages 202 and 203) there is an interesting combina-

Fig. 131 READING ROOM, UNITED ENGINEERING SOCIETIES, NEW YORK CITY

View showing alcove arrangement for study tables. Snead Standard Stack installed in the second tier. Books on each of the various branches of engineering are arranged around their respective alcoves.

tion of the three systems, in a large open-shelf room with two-storied radiating stacks, controlled from the attendant's desk at the center of radiation and forming, by their outward divergence, a series of open alcoves near the windows, each with its readers' tables.

ACCOMMODATIONS FOR READERS

These comprise three principal features: the reading room, card catalogs and delivery desk. The last claims our attention first as the connecting link between the stored books and the readers. It is the central point and focus of the library, in which the three elements of the library meet—books, staff and readers. Theoretically, therefore, it should stand between the stack room and the reading rooms, and this is its usual physical location. Thus placed, it should be so disposed as to "control"—that is, command a view of—the largest possible portion of the public space in front and on either side—entrance, delivery-space, card-catalog-space and reading rooms—and at the same time be in closest proximity to the chief supply of books, which is usually a stack room or stack space. The space behind the delivery desk should be ample for the maximum number of attendants who may at any time serve it; it is better to have it too large than too small. It must be abundantly lighted, preferably by side windows, as overhead lighting by a skylight fails early in the day. On no account should the attendants here be compelled to depend during the daylight hours on artificial light. A sufficient space should be left free in front of the desk for the readers who are awaiting their books or their turn at the desk.

READING ROOMS

Reading rooms are of various kinds: general reading rooms, children's rooms, reference rooms, magazine or periodical rooms, special rooms for fiction, history, art books, technical branches, etc.; special study rooms, seminar rooms, in college and university libraries for conference between students and teachers, etc., etc. Each kind of room demands its special treatment as to size, location and equipment, but certain considerations apply to all alike. The shape may be almost any simple geometrical form consistent with perfect lighting and good service, but it should be without ells, recesses, deep alcoves or encumbering columns and projections—the simpler the better. Circular and octagonal rooms, though often condemned by theorists, present no fundamental objections, and where the alcove or open shelf system prevails, may be made extremely convenient as well as architecturally imposing, as in the beautiful Radcliffe Library at Oxford, the British Museum reading room in London, the Congressional Library at Washington and the Columbia University Library. The objections alleged against these examples are due to defects of planning and arrangement in other respects rather than to the mere form of the room itself.

The most important fundamental consideration in the form of the reading room is its lighting. If lighted from one side, its width should not be more than 50 to 60 per cent. greater than its height to the top of the windows. Windows may have sills as much as 4½ or even 5 feet from the floor in a room of 14 or 15 feet clear height. This allows of wall cases 3½ to 4½ feet high continuously along

the window wall in open shelf rooms. It is the high light that counts in lighting the further parts of the room. A reading room lighted on both sides may be 30 or more feet wide with a height of 15 feet. Skylighting may be employed in certain cases, but as already remarked, it fails early in the day as compared with side lighting, and should never be the sole means of day lighting when side lighting is possible.

Reading rooms should be planned so as to be within easy reach of the stack room, unless restricted to the use of books stored in the reading room itself; and so as to be completely visible and controllable from the central desk or, as in the larger libraries, from that of the special wing or department to which each belongs.

PROVISION FOR THE STAFF

Accommodations for the staff comprise in general: (*a*) offices for the librarian and his assistants; (*b*) catalogers' room or rooms; (*c*) rooms for special services, such as accessions, branch station delivery, etc.; (*d*) workshops for printing, binding, repairing, packing and unpacking books, and for mechanical repairs; (*e*) locker rooms, lunch rooms and rest rooms for the staff; and (*f*) janitor's quarters, store rooms, etc. In large libraries and central libraries, a trustees' room and committee rooms will be required. No general rule can be laid down for these, but in all cases the convenience of the users of the room, good lighting and easy access are the essential considerations. Avoid dark and tortuous corridors, steep and winding stairs, toilet rooms opening directly opposite public rooms or upon conspicuous passages, and study the minor, as well as the greater, amenities and comforts of the service.

HEATING, VENTILATION, ETC.

With regard to heating, ventilating and artificial lighting, each building presents a special problem, and the only general rule to be laid down is that of making excessive rather than inadequate provision for all three, so as to allow for later expansion. The success of a system of heating and ventilation depends less upon the system than upon the way it is designed and carried out. The advice of a competent engineer expert in laying out and superintending the installation of the system should always be sought. The extra expense of such service is in the end an economy and not a loss. With regard to the artificial lighting two things are important, that it should be abundant, and that as far as possible all lights should be prevented from glaring directly into the eyes of the readers. What is called "indirect lighting" should be resorted to as far as practicable. It costs more in current, but saves eyestrain.

PRELIMINARIES TO BUILDING

In undertaking the erection of a library building, supposing an eligible site to have been secured, the first step is to formulate a definite program of the accommodations to be required, in as great detail as possible, with the aid of the librarian if he has had experience in such matters; otherwise with the aid of a consulting expert, who should be either an experienced librarian or an architect of established and varied experience in library design. In some cases it might even be well to employ experts in both professions. The choice of the architect to design the building upon the program thus prepared should be made directly if possible. A competition may be resorted to in the case of a large and important edifice, if the committee in charge find themselves unable to agree upon a direct selection. In that case care must be taken to place the conduct of the competition in the hands of a competent expert and *to make it conform in all respects to the requirements of the Code of the American Institute of Architects*, otherwise it will be impossible to secure the participation in the competition of architects of the highest reputation, whether members of the Institute or not. In the case of large and costly buildings, it is often a wise economy to employ, throughout the whole process of design and erection, a competent consulting architect having no other relation to the enterprise. His disinterested advice is often of the greatest value in preventing or correcting errors of taste or judgment on the part alike of committee and architect, avoiding controversies, and arbitrating them when they arise. Never attempt cheeseparing in the matter of fees and commissions. Competent architects, engineers and expert librarians are worth all they cost, and none other should be employed.

In the matter of cost, it is wise to figure up the approximate actual total cubic contents of all the required areas, from cellar floor to roof, add one-third for walls, stairs, corridors, halls, closets and contingencies, and multiply this by a figure of

Fig. 135. THE MAIN READING ROOM, LIBRARY OF CONGRESS

cost per cubic foot to be furnished by an experienced architect or builder for the type of construction and finish desired. Then cut down your requirements to remove the excess which this calculation almost invariably produces over the sum available—or increase the appropriation. The actual cost of other buildings of approximately like character and size will assist in reaching a fair and practical result. Committees, like many other clients, are apt to require of their architect far more than their funds will allow, and this is not fair, either to the architect or to themselves.

As to construction: except where abundant funds are available, the cost should go into solid construction rather than into architectural splendor. *Build fire-proof whenever possible.* In every case, without exception, the book room or stack room and stacks should be fire-proof; also the stairs and stair halls where a second story exists, and the floor construction above the heating plant. Avoid wooden furring and wooden laths in non-fireproof structures. Take special pains with the roof to avoid possibility of leakage from either rain or snow. Entrust the building of your stacks to none but experienced stack-builders. Remember that first-cost economies may result *in cost for maintenance and repairs far greater than the interest on the saving effected.* Solidity, simplicity, durability and convenience should be the watchwords of every library building committee.

CAPACITY

In figuring on the storage or volume capacity of a library, allow a general average of eight volumes per running foot of single shelving. Law-books may be figured at four or five volumes, children's books at ten volumes, per running foot. Allow on the average 1 foot of height per shelf. Make special allowance for large reference books and art books. Stacks and shelving generally are set up in 3-foot sections, 7 to 7½ feet to a story. Thus a double-faced stack section with seven shelves will hold on the average 7 x 3 x 8 x 2 volumes = 336 volumes; a single-faced or wall section of the same height, 168 volumes. Double stacks are generally set 3 to 4 feet apart. A closely set stack room will contain, when all the shelves are filled, twenty two to twenty-five volumes per story per square foot, eighteen to twenty volumes is a safer estimate. Thus a stack room 20 x 40 feet inside measurement, with six stories of stacks, should accommodate 800 x 20 x 6 = 96,000 volumes. But this makes no allowance for expansion, for which ample room should always be left.

From the "Elementary Principles" laid down by the American Library Association to be observed in library construction, the following counsels are especially commended to the attention of library building committees:

"The interior arrangement should be planned before the exterior is considered.

"Plans should provide for future growth and development.

"A library should be carefully planned for economical administration.

"Public rooms should be planned for complete supervision by the fewest possible attendants.

"No convenience of arrangement should be sacrificed for architectural effect.

"There should be good natural light in all parts of the building. Windows should extend to the ceiling.

"In a book room or stack, windows should be opposite the aisles.

"Flights of stairs should be straight and not circular."

To these excellent counsels may be added:

In public libraries the main floor should be as near as possible to the street level.

Rooms and offices open to the public should be arranged so as to be easily and obviously accessible.

Corridors and communications should be as short, straight and direct as possible. Stairs should have easy steps, never more than twelve between landings, and should not be too wide.

Other things being equal, a building on a simple and obvious plan costs less, both to erect and to administer, than one built on complex lines.

PLANNING A LIBRARY BUILDING

WITH SPECIAL REFERENCE TO BOOKSTACKS

By THEODORE W. KOCH, M. A., Librarian, University of Michigan

Reprinted from "Michigan Libraries," Vol. 1, No. 1, June, 1912

THE rapid development of American libraries is constantly commented upon. There are many ways of gauging this growth: by comparison of the number and sizes of libraries, by statements of the area over which they have spread, or statistics of their use. A comparative study of the older buildings and the new ones will serve equally well the purpose of illustrating the changed conditions. In Boston the old public library on Boylston Street, one of the earliest of the alcove type of building, was vacated a score of years ago. The Boston Athenaeum, recently remodeled, still stands as a representative of this class, where the books are arranged in alcoves, several tiers high, running around the sides of the reading rooms. In New York the Astor Library was the best illustration of this style of library architecture. Most of the larger cities of the East have outgrown this type and moved their book collections into modern structures with splendidly equipped rooms for different classes of readers and fire-proof stacks for the reservoir supply of books. In the main buildings of the public libraries of Detroit and Cincinnati, old alcove structures are still in use and on entering these the visitor is at once impressed with the inaccessibility of the books, the waste of space from a structural standpoint, and the disturbance to readers not only from attendants going to the various alcoves for books, but also from the presence of so many volumes rising in tier over tier of ornate iron supports and shelving. The effect is not productive of a quiet receptive state of mind. Contrast this sort of a reading room with the dignity of Bates Hall in Boston, or the new reading room of the New York Public Library. Here we do not feel overburdened with the accumulation of the ages around us. On open shelves around the room are the most important reference books, while the main stock of books is in the background and the reader has his few selected volumes brought out to him where he can study them in surroundings suited to assimilation. The old idea of the library as a storage place for books is giving way to the modern one of the library as an educational institution where books are to be used as tools. The old alcove construction with all the books in sight helped the reader to realize the storage idea, but to-day everyone knows that the modern stack is the better storage house and it is best to have most of the reading done outside of the stack.

In the earliest buildings equipped with stacks there was a distinct line of demarcation between the stack and the reading room, emphasized by a fire-proof wall. The reading room was quite bare of books, the entire collection being kept in the stack room, which was in consequence called the book room. To-day the reading room must be well equipped with the best up-to-date reference books, some standard authors and open shelves or display racks for popular books, while the stacks are used for the storage of the bulk of the collection. In the smaller libraries the book stack is frequently nothing more than a single tier of compact double-faced shelving at one side or in the back of the reading room, to which everybody has free access. In the larger libraries one sees the stack in its more characteristic form, occupying a separate wing of the building, distinguished on the exterior by the regular rows of narrow windows, close together, suggesting an interior framework of steel, with a range of shelving between each pair of windows, and with glass or marble floors at such a distance apart that a person of average height can with ease reach the books on the uppermost shelf, which nearly touches the ceiling. While the average stack is so planned that the light of day is sufficient to enable an attendant to find any book stored in

it, the use of electric light makes it possible to erect stacks in the interior of buildings and for the storage of less used material under ground. Stacks of this type do not permit the supervision of readers and are not ordinarily open to the general public.

In planning a library the general outlines should be determined by the architect and librarian in consultation. Of recent years we have seen the architects and librarians coming to a better understanding of one another. Mutual concessions have been made and the architect has begun to realize that he can learn something about what a modern library building ought to be by consulting the librarian, and the latter has confessed his dependence upon the architect for putting into concrete shape whatever is practicable in his sometimes unformed ideas as to the relation of the various parts of the building. The change in this respect is illustrated by comparing the splendid accommodations for the public card catalog, the union catalog and the like in the New York Public Library, with the lack of adequate provision for anything of this kind in the Boston Public Library. In one case the librarian planned for this special feature, while in the other the architect was uninstructed on this particular need, or, we might say, the dimensions to which the card catalogs were to grow had not been realized.

Fig. 130 BOSTON PUBLIC LIBRARY

View of reading room, taken before alterations, showing alcove stack arrangement. The same general arrangement but with new Snead Standard Stacks, followed in remodeling

There is a general feeling that the problems of adapting library buildings to the changing methods of library administration will be worked out by the library and the architectural professions jointly. As stated by one architect, the first work must be done by the librarian and should consist in reducing to writing a description of the purpose and scope of the library, particularly helpful if the library be of some such special type as that of a college or university. The study required to formulate and classify his own ideas would doubtless lead the librarian into some new conceptions of the purpose of his library. The future as well as the present must be considered and other libraries should be visited with a mind open for new impressions and ready to graft any improved ideas upon the parent stock.

The architect, having consulted with the librarian and being in possession of his data, should study the problem sympathetically and try to get the point of view of the man who is later to administer

the building and the institution it houses. That the building should be planned from the inside is an axiom not only approved by librarians, but recognized as fundamental by architects. We know of library buildings where the design of the exterior has governed the arrangement of the interior to a lamentable extent, as where a French renaissance exterior of what would seem to a passer-by a one-story building, encases a three-story structure.

There is no special design to which the library exterior can be said to conform. Like the interior, it has changed with the changing methods of library administration. The problem has been to provide rooms of varying sizes, arranged for the carrying on of certain library work, and the exterior is largely determined by the arrangement of these inner factors.

Considerations that will enter into the planning of the library, and especially of the stack, are:

First. The nature of the library, whether a college, university or a public library. The books in a university library are used intensively by a limited number of readers; the under-graduates are not ordinarily admitted to the stacks. In a public library the circulation feature is usually predominant.

Second. Whether wholly a reference library, or partly for circulation, or an open access library. If the public is to be admitted to the shelves, the aisles are naturally made wider than if the stack is primarily for storage and is open to the attendants only.

Third. The size of the library. In a very small library, free access is taken for granted and wall shelving will suffice. For a library requiring only a small stack, but one tier high, and with little likelihood of outgrowing it, a radiating stack is found to reduce the difficulties of supervision. Where more than one tier of metal stacks is built on the radiating principle, the cost of construction is so much higher than in the ordinary parallel arrangement as to be prohibitive.

Fourth. The class of books to be housed. Scientific and technological books require deeper shelving than volumes of *belles lettres*. Books on architecture and the fine arts require special shelving, while newspapers are a problem by themselves. No class of books will eat up the shelving so rapidly as our metropolitan dailies. If the policy of the library is to include any special collection of considerable size along any line it would be very helpful if it were known in advance of planning the building. If bound newspapers are to be indulged in to any great extent it would be desirable to have the stack run below ground where the simplest form of structural work could be used to accommodate these bulky volumes.

One item that will help decide the question of the size of the stack needed is the average annual growth of the library. For the average public library it will be necessary to consider in this connection such factors as the number of books discarded each year, and the number of these that are replaced. In a college or university library the discards are comparatively few, being mainly in the class of text books, and required or collateral reading. In the smaller public library the average number of books out in circulation will enter into the problem. A given amount of shelving will accommodate a certain number of books; but if in a small library one-fifth of the collection is as a rule out in circulation only four-fifths the amount of shelving is necessary that would be required if the books were not allowed to circulate or were of a character which would not tempt readers to borrow them. Of course, it is at no time desirable to have all the shelves filled to overflowing. From a fourth to a third of vacant shelf room ought to be available for shifting the collection when large additions are made or when reclassification of any section becomes desirable.

The custodians of many of our smaller public libraries feel the necessity for constant "weeding out" of their collections, sending to the larger depository libraries of the neighborhood such material as has not been called for within a given time, or disposing by sale of items which seem unsuited to their particular clientele. This tends to keep down the size of the collection and to prevent its growing too rapidly out of its shelf accommodations.

But do what we librarians may, books will accumulate on our hands at a surprisingly rapid rate. The common mistake is to build too small rather than too large a building, and especially too small a stack. I know of one college library that had no sooner been comfortably settled in its new Carnegie building than its custodian was compelled to ask for additional stack room; and I know of a university library which has a building under way with a stack so wholly inadequate that one would think that even the trustees of the institution could see what they were bringing upon themselves—the necessity of an extension within a few years, with

the risk of the usual patchwork effect. It is seldom indeed that a university library is planned with a comprehensive scheme for future development. Students come and go, their numbers increasing but slowly, while the books come, for the most part, to stay. Hence the book storage space is liable to be outgrown much sooner than the accommodations for readers.

A location that must present architectural façades on all sides is unfavorable to extension. It is better to have a distinct front and rear. A corner lot or a site with parking all around it necessitates a greater expenditure for building materials, while an inside lot, with good frontage, admits of a utilitarian stack on the rear without any architectural pretensions whatsoever. Sloping ground is advantageous for practical reasons as giving a chance for a high basement in the rear, with two or more stack levels below the main reading room floor. Of course it is desirable that the library should be separated from other buildings as far as possible, so as to give an abundance of light and air on all sides and to diminish the danger from fire.

To sum up: The first thing for a board of trustees to do in planning a library building is to get a librarian, if a competent one is not already in their service. It will not do to think that a makeshift librarian will answer during the period of planning and building, and that a better one can be engaged after the new building is erected and occupied. It may then be too late to rectify blunders which will represent a serious annual drain on the resources of the library, costing in the aggregate many times the difference between the salary of the makeshift and the competent librarian. The competent librarian should be on hand from the beginning, even before the new building is thought of. He may be needed to point out the necessity for better accommodations, or to create a demand for larger activities. When on hand it will be impossible for him to be ignored. If competent he will make himself so useful to both the trustees and the architect that neither will wish to ignore him in planning for a new building. Of course it is unfortunate that not all librarians realize that they should criticize practical arrangements and not architectural details, and that not all architects understand that the ideas of the librarian should be given the fullest consideration in order to make a truly successful building, which requires first of all that it should be good from a utilitarian point of view and secondly from an aesthetic standpoint. But the architects and the librarians are coming to recognize where their separate provinces lie, what interests they have in common, and how they can co-operate in building the libraries of the future, which, while beautiful, must first serve the purposes of the institutions they house.

SCIENTIFIC LIBRARY PLANNING

By EDWARD L. TILTON, Architect

Reprinted from the Library Journal of September, 1912

PROPER library planning may now be called a science, since it is possible to formulate certain rules which, if carefully followed, will produce a methodical and rational result; it is likewise an art, since it calls for a skillful and systematic arrangement of means for the attainment of some desired end. The combination will produce a construction both practical and aesthetic.

The principles involved require the accommodation of the greatest number of readers or patrons under hygienic conditions, and with due care for their comfort, for the housing of the maximum number of books and contents, and for an aesthetic expression of the building's purpose, both within and without. These principles are fundamental, and are applicable to all libraries; they are likewise sufficiently flexible to admit the inclusion of any new discovery which may develop better arrangements as the science advances. The method of procedure is simple. Given a certain appropriation, not over 80 per cent. should be devoted to the construction, including heating and lighting, and from 20 to 22 per cent. to equipment, furniture and fees. The following formula will apply:

$$x = \frac{.80a}{bc}*$$

In which x equals the size of plan in square feet; (a) equals the appropriation; (b) equals the cost of construction per cubic foot, which for a fireproof building might range from twenty-five to forty cents, and for a non-fireproof building from fifteen to thirty cents, depending upon various local conditions, including prevailing rates of wages and materials; (c) equals the height of the building, measured from the basement floor level to the top of the roof if flat, or half up the slope of the roof if pitched; the height of a basement and one-story building is about 30 feet, and the height of a basement and two-story building is about 40 to 45 feet.

To apply the formula concretely, let us assume the appropriation (a) to be $150,000, 80 per cent. of which would be $120,000. If a fireproof two-story and basement library be required, (b) would equal, say, $.30, and ($c$) 40 feet, or bc would equal 12 which, divided into ($.80a$), $120,000, would give a resultant x of 10,000 square feet, which would permit of a building 100 x 100 feet, 80 x 125 feet, or similar proportions, in deciding which the shape of the lot might be a factor.

With the total appropriation of $150,000, we should endeavor to house 150,000 volumes (or one dollar per volume), and to accommodate 300 readers (at $500 each), allowing a maximum of 30 square feet per seat; this would require 9,000 square feet of floor space for the various rooms destined for the use of readers, such as reading, reference, children's, periodical, newspaper and such special rooms as the librarian may demand for medical and historical collections, club rooms, etc.

The 150,000 volumes may be distributed, allotting approximately 100,000 to the stacks and 50,000 to shelving throughout the various reading rooms. The size of the stack may be determined by dividing the 100,000 volumes by 20, which gives 5,000 square feet for a tier of seven shelves, and allows sufficient space for aisles and gangways; this 5,000 square feet may be arranged in two or more tiers, as the exigencies of the case demand, giving 2,500 square feet if in two tiers of seven shelves each; 1,250 if in four tiers, etc. When possible, it is well to allow 20 per cent. leeway to these figures, in order to avoid close stacking and to give some free shelf space. Several advantages are gained by keeping the stacks below the level of the first floor, as in the new Springfield, Mass., Library, (see pages 202 and 203) and the Somerville, Mass., Library (see page 225) thereby leaving the valuable main floor space free for readers and reference shelving. In the latter building the stacks do not extend to an

*78 per cent. is a closer approximation but 80 per cent. is taken for easy figuring to demonstrate the theory. See the tabulation near the end of this article.

outside wall, but are lighted by "second light" through glazed partitions, leaving the periphery of the building free for reading rooms. This idea is also applicable to stacks extending vertically through the building, and has several decided advantages. Darkness is better for books than direct sunlight, and an interior stack may be readily ventilated. A plan to be economical and well laid out should have a minimum space devoted to corridors and stairways, and a maximum space for library purposes. In "monumental" libraries recently constructed, only 50 per cent. of the ground area is available for library use, the remainder being given up to walls, halls, stairs, etc. In the Springfield Library the similar proportions on the main floor are 85 per cent. and 15 per cent.

In the imaginary problem under consideration, with a ground plan of 10,000 square feet we can assume, therefore, that 8,500 square feet of the main floor may be divided so as to allow, say, for the delivery room 500 square feet; for reading rooms, open shelf rooms for fiction, reference and other rooms as the librarian may designate, 8,000 square feet. The basement may need to accommodate heating and mechanical plants besides stack space, which will reduce somewhat the residuum to be assigned to newspaper rooms, lecture room and work rooms for receiving, unpacking, binding, etc. The second floor's available area may also be less than that of the main floor, owing to possible light wells.

The available areas may, therefore, approximate: basement, 6,500 square feet; main floor, 8,500 square feet; second floor, 5,000 square feet; or a grand total of 20,000 square feet, to be apportioned among the various departments possibly as follows:

Delivery room	500
Several rooms for readers' use	9,000
Stack (area of one tier) . .	3,000
Catalog and work rooms .	2,500
Librarian and staff rooms .	2,500
Lecture rooms	1,050
Collections, etc	1,450

The lecture room, unless usable for other purposes, is apt to make the least return, and should not, therefore, be too large nor occupy valuable space on the main floors. For a building to cost $150,000, the lecture room might be in the basement and limited to 150 seats, which at 7 square feet, will require 1,050 square feet to allow for proper aisles; the height to ceiling should be not less than 12 feet, making 12,600 cubic feet and at 30 cents (the cubic foot cost of our building) will represent $3,780 as the amount invested in the lecture room, the interest on which at 5 per cent. is $189, to which must be added the expense of light, heat and janitor's labor. It is usually better economy to hire a hall in the neighborhood for lectures or entertainments likely to attract large audiences and include only a small lecture room in the library building.

The working space and rooms should be ample to insure the proper running of the machinery of administration. Comfortable quarters for the staff, including rest room, locker room and kitchenette, will yield better returns in efficiency and library results than those obtained from a disproportionate lecture room. A good librarian and an efficient staff are as essential to a library as a competent president and faculty are to a college, and it is equally important to maintain an *esprit de corps* and an *esprit d'ouvrage* if the public are to receive adequate return for their financial and spiritual investment. To insure a continuation of such "dividends," the humanistic element should be considered with a solicitude at least equal to that accorded to the machinery of a steamship.

The comfort and convenience of the public are enhanced by the proper location, arrangement and design of the reading room. The collaboration of librarian and architect is here vitally requisite. The size and shape of any reading room can best be determined by plotting out the furniture. The tables should be spaced about five feet apart and the same distance from the walls of the room. The details are too diverse to enlarge upon here, since the individual preferences of the librarian and the requirements differ with every locality. But a fundamental condition applicable to every case is that of maintaining a reasonable pro rata cost per reader accommodated. In our supposititious problem we have allowed 9,000 square feet for reading and ancillary rooms to accommodate 300 readers at 30 square feet for each. The appropriation being $150,000 makes each of the 300 seatings represent $500 outlay.

The lighting of the library is of paramount importance, and to accomplish a satisfactory result it is well to follow the school house requirements and make the glass area of reading rooms equal to 20 per cent. of their floor areas. The light from

the windows will be effective in the room for a distance equal to about one and one-half times the height of the top of window from the floor. Ceiling lighting will be advisable for spaces not properly illumined by the windows.

A module or width of bays approximately 12 feet, will be found to produce a good relation between solids and openings. For our building of 125 feet by 80 feet, there is no common denominator, so we can modify the dimensions to 129 feet 10 inches by 77 feet 5¾ inches, which will also produce 10,000 square feet, and give ten modules to the front and six modules to the sides of 12 feet 10¾ inches.

Artificial illumination is usually and preferably secured by some electric system. The carbon lamp is yielding to the tungsten lamp, owing to the increased economy secured by its greater power at less wattage. The amount of light required may be roughly figured at one watt (tungsten lighting) for each square foot of floor area when a direct lighting system is used. Indirect or semi-direct will require a little more wattage per square foot. The main floor of our building, with its 10,000 square feet, will therefore require for proper direct illumination enough lamps to yield 10,000 watts. If 30 watt lamps be used, there will be a total of 333 lamps, and if three lamps be used to each fixture, there will be 111 outlets; and if each circuit of twelve lamps has a switch, there will be twenty-eight switch outlets, or a total of 139 outlets, at an approximate cost of $5 each, or $695 for the main floor. It is not necessary, however, to have so many switches, since most of the circuits can be controlled directly from the panel board. This $695 may be reduced to terms per cubic foot. The main floor, with 10,000 square feet, may be assumed to have a height of 15 feet or 150,000 cubic feet, which, divided into $695, gives .46c, or less than one-half cent per cubic foot. The total cubage of our building, including basement and second stories, being 400,000, will require on above basis $1,840 to cover the expense of the wiring for lamps. The panel boards for the several circuits in the reading rooms are best located near the delivery desk, within easy reach of the library attendant.

In addition to the electric light wiring, proper allowances must be made for an interior telephone system and public telephone connections, for call bells, for standard clock system and watchman's clock, for electric book lifts, for all of which, in the building under consideration, we may set aside $4,500.

The heating of the library is usually accomplished by a steam system. The number of square feet of radiation is calculated by the Mills formula of 2-20-200; that is, the sum of the glass area, divided by 2; the solid wall area by 20, and the cubic foot contents of the room by 200. For example, the building we are assuming covers 10,000 square feet, by 10 feet in height, or 400,000 cubic feet; the glass area equals 2,000 square feet (or 20 per cent. of floor area); the wall area equals the periphery of the building (120 + 80 + 120 + 80), 400 lineal feet by 10 feet height, or 16,000 square feet, less the 2,000 feet of glass, or 14,000 square feet. The following formula will apply:

$$x = \frac{ga}{2} + \frac{wa}{20} + \frac{cc}{200}$$

in which x equals the square foot of radiation required; *ga* equals glass area of windows and ceiling lights; *wa* equals solid wall area; *cc* equals cubic contents. Applying this formula to the above figures, we obtain the following results:

$$\frac{2,000}{2} + \frac{14,000}{20} + \frac{400,000}{200} = 3,700$$

square feet of radiation. If the radiation be concealed behind shelving or seats, it should be increased by about one-third, or, say, 1,200 square feet, giving a total of 4,900 square feet, to which add 25 per cent. for supply and return pipes, and another 25 per cent. for reserve power in boiler, or 50 per cent. of 4,900 equals 2,450, giving a grand total of 7,350 square feet, which indicates the requisite boiler rating. The cost of this will approximate 75 cents per foot, or $5,512.50 for heating the building. An additional percentage of radiation should be allowed for walls on north sides and for ceilings under flat roofs, but 5 per cent. of the total appropriation should cover the expense of "direct" steam system.

The mechanical ventilation in an ordinary library building may be limited to the lecture room, and a possible small amount in the shape of "direct-indirect" for certain of the reading rooms, the cost of which would approximate 25 cents additional, or $1,837.50, entailing the total estimate for heating and ventilating of $7,350, or one dollar per foot of of the sum above. A "plenum" system for the entire building is expensive to operate, and experience shows that when installed the use of the fan is apt

to be soon discontinued. The writer has arranged a simple system, first tried at Cleveland and since installed in many buildings, by which the radiators or coils are concealed back of insulated shelving and supplied with openings at floor and at top of cases to permit the circulation of air. When the shelving runs beneath windows, either high or low, there is an opportunity to arrange an effective method of ventilation by opening the window slightly and inserting a deflector. Even with closed windows there is a continual circulation of the room air engendered by the spaces containing radiation between walls and back of shelving, which act like flues.

The furniture will consist of delivery or charging counter, catalog cases, bulletin boards, tables, chairs, shelving and the various items of equipment for the rooms devoted to periodicals, newspapers, fine arts and special collections, as well as the suite for the librarian and staff, for the cataloguing and work rooms, and for the lecture room.

Our building, as [illegible] re stated, is intended to accommodate 300 re[illegible]d for convenience we can assume the table[illegible] the standard three feet by five feet size for four persons, making a total of seventy-five tables and 300 chairs. The 50,000 volumes to be distributed throughout rooms will need about 1000 feet of bookcases, five shelves high in children's room and seven shelves high elsewhere, and will cost about $3,500. Metal shelving can be installed for nearly the same price.

The stacks form an important adjunct to the library. As before indicated, the amount of stack required may be calculated by multiplying the square foot area of the stack room by twenty volumes if but one tier of seven shelves be required; by forty if two tiers be required, and so on. Conversely, if we wish to know the size of stack room necessary to house 100,000 volumes in one tier seven shelves high, we divide by twenty, giving 5,000 square feet; for two tiers divide by forty, giving 2,500 square feet; for three tiers, divide by sixty, giving 1,667 square feet, and so on. Metal stack construction is an invention of recent years, and its rapid development has kept pace with the modern library demands. There are several makes of metal stacks upon the market, each claiming to have special features of superiority over its competitors. The system originally conceived by Bernard R. Green, and installed in the Library of Congress, has since from time to time, been improved and used in buildings where the conditions imposed heavy loadings of superimposed tiers of floors, and also where compactness, as well as strength, was a desideratum. The weight of each tier of stacks, with its complement of books, may be figured at 125 pounds to the square foot. The cost may be roughly computed at $2 per square foot of stack room for each tier, or 10 cents per volume.

To summarize the foregoing, we can subdivide the $150,000 appropriation under the following heads:

General construction, exclusive of heating and electric work	72½%
Heating work with limited ventilation	1 "
Electric work	1¼ "
Stacks	7½ "
Furniture	6 "
Lighting fixture	2 "
Contingencies	00½ "
Architect	6 "
	100%

After analyzing and proportioning the various elements of the plan as indicated, the architect's skill should be invoked to produce an artistic building. The scientific or mathematical consideration of the problem resembles the human skeleton, which is similar in child and adult, black, white and red men, but the flesh covering may over one be beautiful and over another be the reverse.

It is not possible to give more than general hints in an article of this description since there are many ramifications which lead off into various refinements that make for economy of plan and expression in design.

Extracts from an address delivered by Mr. Edward L. Tilton before the Ohio & Michigan State Library Associations, Cedar Point, Ohio, September 4th, 1914.

"The cost per cubic foot of a building, thoroughly fireproofed throughout, including floors and roof and faced with stone or even marble, can be brought to 30 cents, and including best stacks and equipment to 35 cents. A non-fireproof brick and terra cotta building, well finished, can be brought to 20 or 25

cents, and in some cases to a little under 20 cents.

"The following computations have been made of the cost of a building in relation to its seating capacity for readers and to its volume capacity: Allowing 30 square feet floor space to each reader as full capacity in rooms allotted to reading and reference purposes, then $500 per reader should easily cover the cost of an average suitable building and permit the inclusion of a lecture room and all the necessary elements and accessories. The cost of housing books varies from one to two dollars per volume, the former where stack construction and wall shelving in reading room is used, the latter if the open shelf and wall shelving is adopted. The first type of shelving brings the book to the reader; the second, the reader to the book.

"The location of a branch building in towns of the second or third class is probably best determined by the conditions geographical, topographical or racial, and the size and cost of the building by the number of population in the section to be served reckoned roughly at about two dollars per capita. A city of about 300,000 population and covering say an area of 30 square miles would have possibly one-third of the people served directly by the central building, leaving 200,000, or 7,000 people per square mile beyond the center, and each branch might serve four square miles; *i.e.*, a mile each way from the branch, or 28,000 people, requiring therefore in the city a total of seven branches. Business centers also control the location of branches.

"When a building, as before stated, costs about $2 for every volume housed therein, the cost of interest and maintenance might be approximated as 35 cents per volume, as representing the minimum annual average expense of each book upon the shelves. Or to put it in another way, 25,000 volumes will require, say, a $50,000 building. Add for expense of land, say, $5,000, making building and land cost $55,000 on which interest at 5 per cent amounts to $2,750. To this add annual upkeep charges such as salaries, light, heat, etc; say, $6,000, or total of $8,750 for 25,000 volumes, which give an average amount of 35 cents per volume as a minimum for a small library."

A LIBRARY BOOKSTACK IN THE DARK

By BERNARD R. GREEN, C. E.

Read at the Baltimore meeting of the American Association for the Advancement of Science, 1909

UNTIL recently the free admission of daylight had been deemed an indispensable requisite in the bookstacks of libraries. Masses of shelving were wont, on that account, to be kept small because artificial illumination was not only inadequate and expensive, but overheating and dangerous. The breadth of aisles was limited to secure even a moderate amount of daylight. It was likewise considered necessary to locate the exterior walls so that they would give not only free access to the light, but would insure a safe distance from exterior fire. To all this handicap was added the even greater necessity of a proper regard to architectural appearance.

Under such conditions large isolated lots and wide courts seemed to be the only solution at hand. The bookstacks, in consequence, extended over wide areas at ever increasing distances from the center of use. But even here there were limits—the walls must not be so high as to overshadow each other. The result was that not more than a third of the ground devoted to the stack could be used by it. Added to this inconvenience was not only the costly space-consuming expanse of exterior but the proverbial fickleness and frequent failure of the daylight, due to cloudy weather, the time of day and the seasons of the year. These accumulated uncertainties have at last not only rendered artificial illumination a necessity, but an economic advantage.

Moreover, sunlight is often so bright and hot that it becomes injurious to the exposed books, thereby making adjustable shades an indispensable part of the equipment of a stack room. Now, window shades, it is well known, are not only expensive in their first cost and in their maintenance, but they are also expensive in the time and the annoyance they require for their operation. Even the diffused daylight, which their adjusted aid gives, is more or less injurious to books in the long run. Books, in fact, are much better off in the dark.

In the construction and arrangement of a bookstack, therefore, the maximum of economy will be reached if the shelving be so compacted that only space for convenient access to all the books is provided. That is to say, every possible cubic foot of the entire bulk of the stack should be available for the books themselves and the minimum of the cubic contents taken up by the stack structure and the space necessary for access to the books.

Such a structure is at the present day made entirely feasible by the use of light steel framework and shelving, mechanical elevators and book carriers, artificial ventilation, and the incandescent electric light, or tungsten lamp. The Library of Congress has used such a stack to fill up one of its courts. The court is about 150 feet long, 74 feet wide and 80 feet high, with a roof resting on the numerous slender steel columns which carry the stack structure, from the foundation to the roof. There are nine tiers or stories of shelving with a low basement for the distribution of fresh air circulating upward through the stack and discharged at the roof. Great economy in the consumption of electric current is secured by the use of time-limit switches which automatically turn off the lights a few minutes after they are connected.

The fact that the stack is enclosed in a court and surrounded by a heated building makes the heating of it a simple matter, because only a moderate quantity of fresh air is needed to counteract the relatively slow vitiation of the interior air of the stack. The heating of such a stack may be done with either direct or indirect radiators. Those containing warm water are preferable. As the stack decks contain sufficient openings for ventilation, neither flues nor special airways are needed for the passage of the constantly upward flow of the air, which is controlled by plenum and exhaust fans at the bottom and top respectively.

In economy of space, in bulk, simplicity, and consequent low cost of construction and maintenance, such a stack is analogous to an ice house, which is but a protecting plain shell or envelope, filled solidly

Fig. 137. SOUTHEAST COURT, LIBRARY OF CONGRESS

Steel frame for the nineteen Snead Standard Stack, in course of construction. Roof over stack carried by this steel frame.

with ice. The purpose of the shell is not to carry floors or roof, or shelving, but is to exclude weather and fire and to prevent depredation. Viewed in this light, the stack may be built as a simple mass of shelving within the walls of an existing court as at the Library of Congress, or it may be built within solid plain walls constructed for the purpose, without windows or openings. In fact, such a stack may be built, embodied and concealed, anywhere within a library building, local conditions of space, cost, administration, and architectural considerations being the only determining factors.

The bookstack, especially if it were a large one, has up to this time been the *bête noir* of the architect, who not only sought to give it the demanded daylight but also to harmonize its architecture with that of the rest of the building. To-day the shape of the bookstack, its location, dimension and frontage are relieved of the all-controlling daylight stipulation. It may be a tower or a well, or both combined, or an inside mass hidden or buried, invisible and unsuspected, leaving the well-lighted, attractive spaces for the various Library purposes. With such a bookstack, books may be very conveniently read in the daylight and then stored away safely in the dark.

The height, length and breadth of such a stack are limited only by the economy of elevator service, ground damp proofing and lateral distance from the center of administration or use. It is obvious, however, that these limitations admit of enormous possibilities. Why, for example, might not a stack be forty tiers high and 100 feet square, holding in conveniently accessible arrangement, 100 millions of volumes and occupying but one ordinary city block?

Fire is not a serious danger with such a bookstack, because books, as they are ordinarily placed on the shelves, do not burn or communicate fire readily, and the stack itself is wholly fireproof. If so desired, the long stack may be divided vertically by a fireproof wall and the tall stack horizontally by fireproof flooring, into compartments, like the hull of a ship.

BIBLIOGRAPHY

"LIBRARY Building, Some Preliminaries," by F. P. Hill, in *Library Journal*, 1899, vol. 24, pp. 563-569, emphasized the necessity for enthusiasm on the part of the librarian, the importance of interest among the trustees, visits to other libraries, methods of securing money, function of the consulting architect, the selection of a site, conditions of competition and award of contracts. Some of the remarks center around the Newark Public Library, on which compare W. K. Stetson, "Planning for Efficiency in Library Buildings," in *Library Journal*, 1914, pp. 167-168. J. C. Dana has a helpful note in *Public Libraries*, 1902, pp. 406-407.

Papers by the late Bernard R. Green, "Planning and Construction of Library Buildings," in *Library Journal*, 1900, vol. 25, pp. 677-683, and "Library Buildings and Book Stacks," in *Library Journal*, 1906, vol. 31, pp. 52-56 contain many excellent suggestions. A paper by Edward B. Green, a Buffalo architect, in *Library Journal*, Dec., 1901, vol. 26, pp. 865-867, takes up general principles and discusses some special buildings. He quotes the article by C. K. Bolton, "The Planning of Small Libraries," in *The Brickbuilder*, 1901, (abstracted in *Public Libraries*, 1901, vol. 6, p. 620). J. L. Mauran, of St. Louis, published "Housing the Books," in *Public Libraries*, 1901, pp. 603-606, and a paper on the "Relation of the Architect to the Librarian," is summarized in the same volume, pp. 175-176. Other papers by architects are: W. A. Otis, "Library Buildings from the View-point of an Architect," in *Public Libraries*, vol. 8, pp. 202-207; Grant C. Miller, "Library Buildings," in *Iowa Library Quarterly*, vol. 3, pp. 1-8; Norman S. Patton, "Designing of a College Library," Asheville meeting of the American Library Association, 1907, (Proc., pp. 270-271). Edward L. Tilton, at the joint meeting of the Ohio and Michigan Library Associations, gave an illustrated lecture on the architecture of small libraries, (published in *Michigan Libraries*, Dec., 1911). See also "The Views of a Consulting Architect," by A. D. F. Hamlin, Narragansett Conference of the A. L. A., 1906, (Proc., pp. 57-62).

Charles C. Soule published in *Library Journal* for April, 1892, an article entitled "How to Build a Library." See also "How to Plan a Library Building for Library Work," by Mr. Soule, (Boston Book Co., 1912). "Points of Agreement Among Librarians as to Library Architecture," by Mr. Soule, appeared in the Brochure Series of *Architectural Illustrations* for Nov., 1897, which also contained a brief paper on "Library Architecture," by the late Russell Sturgis, and "Planning a Library from the Librarian's Point of View," by William E. Foster. "New Ideas in Library Buildings," by Mr. Foster, as published in the *American Architect*, July 30, 1898, vol. 61, pp. 38-39, are extracted from his report to the A. L. A. in 1898, the full text of which is found in the *Library Journal*, vol. 23, C pp. 13-17. The A. L. A. Publishing Board issued in 1902 as "Library Tract," No. 1, a condensed study of "Library Rooms and Buildings," by Mr. Soule. See also Mr. Soule's article in Sturgis's "Dictionary of Architecture and Building," vol. 2, pp. 749-759. W. R. Eastman, late library inspector for the State of New York, has published papers on library buildings in *Public Libraries*, 1901, vol. 6, pp. 474-475, and *Library Journal*, 1904, vol. 26, C pp. 38-43. In revised form the latter paper was reprinted by the New York State Library and by the A. L. A. Publishing Board, 1908. An article by Mr. Eastman on "Library Buildings of Moderate Size" appeared in *Library Journal*, vol. 27, pp. 80-81.

Amian L. Champneys, an English architect, has published "Public Libraries, a Treatise on their Design, Construction and Fitting, with a Chapter on the Principles of Planning," (London, Batsford, 1907) which will be found more useful to British than to American students of the subject. "Small Library Buildings: a collection of plans contributed by the League of Library Commissions, with introduction and notes by Cornelia Marvin," (A. L. A. Publishing Board, 1908) will prove helpful alike to architects, librarians and trustees. "A Portfolio of Carnegie Libraries," by Theodore W. Koch, (Ann Arbor, George Wahr, 1907) contains exterior and interior views, with floor plans, of some eighty libraries.

SNEAD STACK INSTALLATIONS

PARTIAL LIST WITH COST DATA

SOME general information on the cost of library buildings may be found on page 106 of Professor A. D. F. Hamlin's article, "Some Essentials of Library Design" and in Mr. Edward L. Tilton's article, "Scientific Library Planning," page 113.

Regarding the relative costs of buildings, Architect Grant C. Miller writes, "In comparing the costs of buildings one should not compare the cost per cubic foot of a large building with that of a small building, as a small building will cost slightly more in proportion. It is almost impossible to compare the cost per cubic foot of a building designed by one architect with that of a building designed by another architect. There are as many different ways of measuring and comparing as there are individuals. We take the cubic contents from the cement floor in the basement to the top of the ceiling joists in the top story. You will note that the attic spaces are not measured. Of course it is not wise to compare a steep pitched roof with a flat roofed building, but compare only buildings of a similar type. We find that public library buildings, not fireproof but of especially good construction otherwise, cost anywhere from 17 to 25 cents a cubic foot. The classic style of architecture costs from about 20 to 25 cents a cubic foot, and other styles of a more economical nature from 17 to 20 cents. The library for the University of Tennessee at Knoxville (non-fireproof) cost about 23 cents a cubic foot. The library for Purdue University at Lafayette, Ind. (fireproof) cost 27 cents a cubic foot. Both of these buildings are in comparatively cheap localities. If one were to erect buildings of this type in Iowa, Minnesota, or even Wisconsin, the price per cubic foot would be a little higher. In general, fireproof buildings cost about 20 per cent more than those that are not. In quoting the price per cubic foot for building, we have included most of the equipment, that is, the equipment of the first floor in the public libraries and nearly all of the equipment in college libraries."

Note. Name of librarian given below is either that of the librarian in office at time of stack installation, or of the librarian in charge at date of compilation of this list.

WASHINGTON, D. C.

Building	Page	Architect	Librarian	Year Completed	Cost	Cubic Foot Contents	Cost per Cubic Foot
Library of Congress	130	Smithmeyer & Pelz and E. P. Casey. Bernard R. Green, Eng.	Herbert Putnam	1897	$6,[illegible],000	10,000,000	$.6[illegible]
Washington Public Library	217	Albert Randolph Ross	George F. Bowerman	1912	$570,000	900,000	$.91
Army War College		McKim, Mead and White		1907	$700,000	2,500,000	$.28
Engineer's School		McKim, Mead and White	Henry F. Haferkorn	1911	$3,[illegible],000	177,000	$.21
Department of Agriculture		Rankin, Kellog & Crane	Miss C. R. Barnett	1910			
U. S. Soldiers Home			Herman Miller				
Bureau of Education			J. D. Wolcott				
Bureau of Coup Estimates			Louise Hayward				
Bureau of Mines		. .	Mrs. L. F. Spofford				
Bureau of Plant Industry		. . . . .	Cora L. Feldkamp				

NEW YORK AND NEW JERSEY

New York Public Library	148	Carrere & Hastings	Edwin H. Anderson, Dir	1911	$9,[illegible],000	10,[illegible],000	$.87
Columbia University Library, N. Y. City	148	McKim, Mead & White	F. C. Hicks, Acting Libn	1897	$1,[illegible],500	1,530,000	$.31
American Museum of Natural History, New York City		Trowbridge & Livingston	Dr. R. W. Tower				
United Engineering Societies, N. Y. City	165	Howes & Morse	Wm. P. Cutter	1907			
American Society of Civil Engineers, New York City		Ludlitz & McKenzie	Chas. W. Hunt	1897			
Kent Hall, Columbia University Law School, New York City	169	McKim, Mead & White. F. A. Goetze, Consulting Engineer	F. C. Hicks, Acting Libn	1910	$400,000	1,000,000	$.39
American Geographical Society, N. Y. City	251	Chas. P. Huntington	D. Randall MacIver	1910			

THE SNEAD AND COMPANY IRON WORKS, LTD.

NEW YORK AND NEW JERSEY — *Continued.*

Purpose	Page	Architect	Libraries	Year Completed	Cost	Cubic Foot Contents	Cost for Cu. Ft.
Union Theological Seminary, N. Y. City	198	Allen & Collens	Dr. H. Preserved Smith	1910	$[illegible]	[illegible]	$ [illegible]
Syracuse Public Library, Syracuse, N. Y.	240	James A. Randall	Ezekiel W. Mundy	[illegible]	$ [illegible]	[illegible]	$ [illegible]
Russell Sage Foundation Library, N. Y. City	254	Grosvenor Atterbury	Frederick W. Jenkins	1911			
Jewish Theological Seminary, N. Y. City	83	Arnold W. Brunner	Prof. Alexander Marx	[illegible]	$[illegible]	[illegible]	$ [illegible]
Cattaraugus Historical Society and Wood Library, Canandaigua, N. Y.		Claude Bragdon	Inez Lee	[illegible]	$[illegible]	[illegible]	$ [illegible]
Elizabeth Public Library, Elizabeth, N. J.	230	Edward L. Tilton and R. Goulter Poggi, Associated Architects	Chas. A. Gueraze	[illegible]	$[illegible]	[illegible]	$ [illegible]
Williamsburg Branch Lib., Brooklyn, N. Y.	241	Walker & Morris	Frank P. Hill	[illegible]	$[illegible]	[illegible]	$ [illegible]
Pacific Branch Library, Brooklyn, N. Y.	242	Raymond F. Almirall	Frank P. Hill	[illegible]	$[illegible]	[illegible]	$ [illegible]
Carroll Park Branch Lib., Brooklyn, N. Y.	[illegible]	Wm. B. Tubby & Bro.	Frank P. Hill	[illegible]	$[illegible]	[illegible]	$ [illegible]
New Rochelle Public Library, New Rochelle, N. Y.	[illegible]	Albert Randolph Ross	Jessie Brunerd	1911	$[illegible]	[illegible]	$ [illegible]
Cornell University Law Lib., Ithaca, N. Y.		Wm. H. Miller	F. E. Wellever	[illegible]	$[illegible]	[illegible]	$ [illegible]
St. Elizabeth's College Library, Convent Station, N. J.	186	Maginnis & Walsh	Sister Marie Elise	[illegible]	$[illegible]	[illegible]	$ [illegible]
Frances Lobsons Cleveland Library, Wells College, Aurora, N. Y.	181	Beverly S. King and Harry Lee Walker, Associated Architects	Alice E. Sanborn	1911*	$[illegible]	[illegible]	$ [illegible]
Montclair Free Lib., Upper Montclair, N. J.		Nelson & Van Wagenen	Helen M. Herring	1911*	$[illegible]	[illegible]	$ [illegible]
Coburn Free Library, Oswego, N. Y.	57	H. Sumner Gardener	Lillian L. Foster	1912	$[illegible]		
Summit Free Public Library, Summit, N. J.		Earl Harvey Tyall	Mabel R. Haines	1911*	$[illegible]	112,000	$ [illegible]
Hispanic Society of America, N. Y. City	231	Chas. P. Huntington	F. L. Stevenson, Secy.	[illegible]			
Cooper Union Library, New York City			C. R. Richards, Director	[illegible]		[illegible]	
G. P. Putnam's Sons Co., Fifth St. Book Store, New York City	46						
Lotos Club, New York City		Donn Barber	W. Green	[illegible]			
Private Library of Thomas Mott Osborne, Auburn, N. Y.		Henry William Wilkinson					
Flower Memorial Library, Watertown, N. Y.		Gelaud, Lansing & Jordeinon	S. Y. Hoyt	1911			
Rochester Theological Sem., Rochester, N. Y.		J. Foster Warner	Glenn H. Lowell	1912			
General Theological Seminary, N. Y. City		Charles C. Haight	Edward Harmon Virgin	[illegible]*			
			Rebecca Richards	1911			
Little Falls Public Lib., Little Falls, N. Y.			Mabel E. Richards	1880*			
The Association of the Bar of the City of New York		Cyrus L. W. Eidlitz	Franklin O. Poole	1896			
New York Law Assn. Library, N. Y. City		L. S. Supervising Architect					
Y. M. C. A. of New York City		Parish & Schroeder	Miss L. R. Petro				
New York Genealogical and Biographical Society, New York City			Abraham Hatfield				
American S. P. C. A. of New York City		Renwick, Aspinwall & Owen		1898			
Union College Library, Schenectady, N. Y.			DeWitt Clinton				
Rochester Medical Assn., Rochester, N. Y.							

NEW ENGLAND STATES

Widener Memorial Library, Harvard University, Cambridge, Mass.	152	Horace Trumbauer	William Coolidge Lane	[illegible]			
New Hampshire Historical Society, Concord, N. H.	250	Guy Lowell	Otis G. Hammond, Supt.	1912	$[illegible]	67,000	$ 7.1
Boston Athenæum, Boston, Mass.	253	Bigelow & Wadsworth, Architects of remodeling	Charles K. Bolton				
			Rebecca Rich	1911			
Springfield City Library, Springfield, Mass.	262	Edward L. Tilton	Hiller C. Wellman	1912	$[illegible]	1,000,000	$ [illegible]
Blackstone Memorial Library, Branford, Ct.		S. S. Beman	Chas. N. Baxter	1896	$[illegible]	112,000	$ [illegible]
Brookline Public Library, Brookline, Mass.	210	R. Clipston Sturgis	Louisa M. Hooper	1910	$[illegible]	[illegible]	$ [illegible]
Manchester Public Lib., Manchester, N. H.	238	Edward L. Tilton	F. Mabel Winchell,	1911	$[illegible]	745,000	$ [illegible]
Andover Harvard Theological Seminary, Cambridge, Mass.	170	Allen & Collens	Dr. Owen W. Gates	1911	$[illegible]	[illegible]	$ [illegible]
Fall River Public Library, Fall River, Mass.	201	Cram, Goodhue & Ferguson	Geo. W. Rankin	1900			
Lynn Public Library, Lynn, Mass.		Geo. Y. Moore	Harriet L. Matthews	1910	$225,000		
New Hampshire State Lib., Concord, N. H.		Y. P. Cutting	Arthur H. Chase	1905			
Mason Library, Great Barrington, Mass.	229	Blanchard & Barnes	Emma J. Sheldon	1913	$31,500	148,500	$ .47
Somerville Free Public Library, Somerville, Mass.	225	Edward L. Tilton	Drew B. Hall	1913	$[illegible]	147,000	$ .28
Beverly Public Library, Beverly, Mass.	232	Cass Gilbert	Martha P. Smith	1913	$[illegible]	240,000	$ [illegible]
Bangor Public Library, Bangor, Me.	228	Peabody & Stearns	Charles Y. Flagg	1911*	$[illegible]	361,000	$ [illegible]
Williams Memorial Library, Trinity College, Hartford, Conn.	187	La Farge & Morris	Walter B. Briggs	1914	$[illegible]	112,500	$ .18
Perkins Institute for the Blind, Watertown, Mass.		R. Clipston Sturgis	Laura Sawyer				
Proctor Public Library, Proctor, Vt.	57	Harry Leslie Walker	Mary K. Norton	1913*	$[illegible]	74,000	$ .41
Hartford Medical Society Library Wing, Hartford, Conn.	40	Y. Raymond Ellis	Dr. Walter R. Steiner	1912	$15,000	58,000	$ .26

* Of non-fireproof construction

NEW ENGLAND STATES—*Continued*

Building	Page	Architect	Librarian	Year completed	Cost	Cubic feet contents	Cost per cu. ft.
Schaffer Memorial Library, Mt. Hermon, Mass.	80	Parish & Schroeder	Elizabeth Conway	1912	$12,500	125,000	$.10
Southboro Public Lib., Southboro, Mass.	190	Alfred Cookman Co.	Francena E. Buck	1912	$10,800	70,000	$.16
Whitinsville Public Library, Whitinsville, Mass.	208	R. Clipston Sturgis	Mrs. W. H. Fuller	1911	$50,000	311,000	$.16
Converse Memorial Library, Malden, Mass.		H. H. Richardson Shepley, Rutan and Coolidge	H. W. Dixon	1884 1896	$140,000		
Davis Memorial Library, Phillips Exeter Academy, Exeter, N. H.	198	Crane, Goodhue & Ferguson	Mabel Culley	1912	$75,000		
Jacob Edwards Library, Southbridge, Mass.		Little & Browne	Ella E. Morsch	1915			
Ferguson Memorial Library, Stamford, Conn.	23	Tracy, Swartwout & Litchfield	Alice M. Colt	1911	$63,000	311,000	$.20
Rhode Island Medical Society, Providence, R. I.	52	Clarke, Howe & Homer	Dr. Geo. H. Hershey	1912	$41,000	171,500	$.24
New England Historical and Genealogical Society, Boston, Mass.		Brainerd & Leeds	Wm. P. Greenlaw	1913	$77,800	303,000	$.28
Portland Public Library, Portland, Me.		F. H. Fassett	Alice C. Earlbush	1899*			
East Greenwich Free Library, East Greenwich, R. I.		Angell & Swift	Mrs. Ella D. Chapman	1915*			
Dalton Public Library, Dalton, Mass.		H. Neill Wilson	Mrs. M. L. Davidson	1893*			
Canton Public Library, Canton, Mass.		Bigelow & Wadsworth	Mrs. Wm. L. Downes	1902	$60,000	1,21,000	$.49
J. V. Fletcher Library, Westford, Mass.		H. M. Francis	Mary C. Bunce	1906*	$19,000	111,000	$.16
Hyde Park Public Lib., Hyde Park, Mass.		Clark & Russell	Elizabeth Ainsworth	1890			
Robert Hoar Library, Littleton, Mass.		Perkins & Betton	Cora Whitcomb Davis	1904			
Howe Library, Sherborn, Mass.		H. P. White	Elizabeth Howe Coolidge	1914			
Howe Library, Hanover, N. H.		C. W. Hoyt	Etta M. Clark	1771			
			Stack wing	1914	$40,000	50,850	$.85
Dunbarton Public Lib., Dunbarton, N. H.			Ruth Emerson	...			
Fitchburg Historical Society, Fitchburg, Mass.		H. M. Francis & Son	Theresa N. Garfield	1912	$26,000	71,000	$.36
Providence Diocesan Office and Library, Providence, R. I.		Murphy, Hindle & Wright	Rt. Rev. Matthew Harkins, D.D., Bishop, Providence	1914	$27,500	85,000	$.32
Redwood Lib. and Athenæum, Newport, R. I.			George L. Hinckley	1913			
Vermont Free Public Library, Montpelier, Vermont.			Rebecca W. Wright				
Masonic Library, Boston, Mass.		Loring & Phipps	Thomas W. Davis, Recording Grand Secretary				
Meriden High School Library, Meriden, Ct.		Gulbert & Betelle	Willis J. Prouty, Principal	*			
Ridgefield Memorial Library, Ridgefield, Ct.		Raleigh C. Gildersleeve	Jennie Smith	1913			
Connecticut Agricultural Experimental Station, New Haven, Conn.			Miss V. F. Cole	1882*			
Maine Historical Society, Portland, Me.		F. H. Fassett	Evelyn L. Gilmore, Librarian and Curator	1907			
Caribou Public Library, Caribou, Me.		Astle & Page	Sarah A. Roberts	1912*	$10,000	51,000	$.19
Exeter Public Library, Exeter, N. H.	81	Roach and Libbey	Carrie W. Remington	1893*			

PENNSYLVANIA AND DELAWARE

Building	Page	Architect	Librarian	Year completed	Cost	Cubic feet contents	Cost per cu. ft.
College of Physicians, Philadelphia, Pa.	251	Cope & Stewardson	Dr. Chas. Perry Fisher	1909	$300,000	905,400	$.42
Academy of Natural Sciences, Phila., Pa.		Wilson, Harris & Richards	Edward L. Nolan	1909	$155,000	452,000	$.31
Haverford College Library, Haverford, Pa.		Baily & Bassett	A. C. Thomas	1912	$12,993	52,700	$.25
Biddle Law Library, University of Pennsylvania, Philadelphia, Pa.		Stewardson & Page	Mrs. M. C. Klingelsmith	1901			
Delaware State Capitol, Dover, Del.	19	Edward L. Tilton	Thomas W. Wilson	1911			
American Philosophical Society, Phila., Pa.		Frank Miles Day & Bro.	Dr. I. Minis Hays	1789 1889			
Pittsburg North Side Carnegie Free Library, Pittsburg, Pa.		Henry D. Whitfield	Edward E. Iggers	1890	$450,000		
Bradford Public Library, Bradford, Pa.		Edward L. Tilton	Susan L. Sherman	1911*	$10,[illegible]	41,480	$.24
Reading Public Library, Reading, Pa.		Henry D. Whitfield and Alex. T. Smith, Associated Architects.	Edward A. Howell	1913			
Theological Seminary of St. Charles Borromeo, Overbrook, Pa.	176	Harris & Richards	Father A. J. Schulte				
			Stack wing	1910	$161,000	974,500	$.16
Drexel College, Philadelphia, Pa.	186	Pilcher & Tachau	Dr. Cyrus Adler	1912	$72,500	233,000	$.26
Krauth Memorial Library, Mt. Airy, Pa.	180	Watson & Huckel	Rev. Luther D. Reed	1908	$59,300	329,400	$.18
Zoological Laboratory, University of Pennsylvania, Philadelphia, Pa.		Cope & Stewardson	Morris Jastrow, Jr.	1911			
University of Pennsylvania Lib., Phila., Pa.		Furness & Evans	Morris Jastrow, Jr.	1891			
Van Wickle Memorial Library, Lafayette College, Easton, Pa.	192	Harris & Richards	John C. Stoneqipher				
			Stack wing	1911	$11,100	133,500	$.17
Newtown Public Library, Newtown, Pa.	239	Henry L. Reinhold, Jr.	W. F. Martindale	1911*	$14,500	37,000	$.42
Gratz College, Philadelphia, Pa.		Pilcher & Tachau		1909	$25,000	99,300	$.24
U. S. Naval Home, Philadelphia, Pa.							
Jefferson Medical College Lib., Phila., Pa.		J. F. Windrim	Charles Frankenberger	1899			

* Of non-fireproof construction

THE SNEAD AND COMPANY IRON WORKS, LTD.

SOUTHERN STATES

Building	Page	Architect	Librarian	Year Com.	Cost	Cubic Foot Contents	Cost per Cu. Ft.
[illegible] Johns Hopkins University Library, Baltimore, Md.	[illegible]	[illegible] & [illegible]	M. Llewellyn Raney	[illegible]	[illegible]		
University of North Carolina Library, Chapel Hill, N. C.	[illegible]	Frank P. Milburn & Co.	Louis R. Wilson	[illegible]*	$15,000		
Hill Memorial Lib., Louisiana State University, Baton Rouge, La.		[illegible]	[illegible]	[illegible]*			
University of Tennessee Library, Knoxville, Tenn.	[illegible]	[illegible] & [illegible]	Sabra W. Vought	[illegible]*	[illegible]	[illegible]	[illegible]
Tulane University Lib., New Orleans, La.	[illegible]	De Buys, Churchill & Labouisse	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible] B. Wheaton	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Library, [illegible], Ky.	[illegible]	[illegible] & [illegible]	George T. Settle	[illegible]	[illegible]	[illegible]	[illegible]
Virginia State Library, Richmond, Va.		W. M. Poindexter	H. R. McIlwaine	[illegible]			
[illegible] State [illegible]		E. C. Myers	E. W. Winkler	1888*			
George Peabody College for Teachers, Nashville, Tenn.		Ludlow & Peabody	[illegible]				
Medical and Chirurgical Faculty of Md., Baltimore, Md.	[illegible]	[illegible] & [illegible]	Marcia C. Noyes	[illegible]*	[illegible]	[illegible]	[illegible]
Medical College of Georgia, Augusta, Ga.		Lewis Goodrich [illegible] remodeling		[illegible]*			
[illegible], Baltimore, Md.	[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]		W. A. Edwards	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]
[illegible]		Edward L. Tilton	[illegible]	[illegible]*	[illegible]		
[illegible], W. Va.		Charles W. Bates	[illegible] M. Roberts	[illegible]*			
[illegible] Lib. [illegible], Tex.		Wm. Albert Lackey	[illegible]	*			
[illegible], Miss.		Cleveland & Godfrey	Mrs. W. R. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] College Library, Columbia, S. C.			M. Virginia [illegible]	[illegible]*			

CENTRAL STATES

Building	Page	Architect	Librarian	Year Com.	Cost	Cubic Foot Contents	Cost per Cu. Ft.
Harper Memorial Library, University of Chicago, Chicago, Ill.	[illegible]	Shepley, Rutan & Coolidge	Dr. Ernest D. Burton	[illegible]	[illegible]		
University of Michigan Library, Ann Arbor, Mich.	[illegible]	Albert Kahn, Architect of remodeling	Theodore W. Koch				
Ohio State University Lib., Columbus, O.	[illegible]	Allen & Collens	Olive Jones	[illegible]*	[illegible]	[illegible]	[illegible]
University of Illinois Library, Urbana, Ill.		James M. White, Sup. Archt.	Phineas L. Windsor	1897	[illegible]	[illegible]	[illegible]
Purdue University Library, Lafayette, Ind.	[illegible]	Patton & Miller	Wm. M. Hepburn	[illegible]	[illegible]	[illegible]	[illegible]
University of Wisconsin, Agricultural Hall Library, Madison, Wis.		Arthur Peabody	Walter M. Smith, C. S. Hean, Dept. Librarian				
[illegible] Library, [illegible], Wis.	[illegible]	George B. [illegible]	Gilson G. Glasier				
Indiana State Normal School, Terre Haute, Ind.	[illegible]	J. L. Alexander & Sons	Arthur Cunningham	[illegible]	[illegible]	[illegible]	[illegible]
Gary Public Library, Gary, Ind.	[illegible]	H. D. Whitfield and J. Ver[illegible]planck, Associated Architects	Louis J. Bailey	1912*	[illegible]	[illegible]	[illegible]
Evanston Public Library, Evanston, Ill.	[illegible]	James Gamble Rogers and Chas. A. Phillips	Mary B. Lindsay	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Hall, University of Illinois, Urbana, Ill.	[illegible]	James M. White, Supervising Architect	Phineas L. Windsor	[illegible]	[illegible]	[illegible]	[illegible]
Hebrew Union College Lib., Cincinnati, O.	[illegible]	A. Lincoln Fechheimer	Adolph S. Oko	1912	$80,000	[illegible]	[illegible]
Wisconsin State Historical Society, Madison, Wis.		Ferry & Clas	M. M. Quaife, Supt.	[illegible]	[illegible]	[illegible]	[illegible]
Ohio Mechanics Institute, Cincinnati, O.		Samuel Hannaford & Son	John L. Shearer	[illegible]	[illegible]	[illegible]	[illegible]
Akron Public Library, Akron, O.	[illegible]	Frank Weary	Mary Pauline Edgerton	[illegible]	[illegible]		
Natural History Building, University of Illinois, Urbana, Ill.		James M. White, Supervising Architect	Phineas L. Windsor	[illegible]*			
U. S. Naval Training Station, North Chicago, Ill.		Jarvis Hunt	Rev. Frank Thompson	1911			
Transportation Building, University of Illinois, Urbana, Ill.		James M. White, Supervising Architect	Phineas L. Windsor	1912			
Western College for Women, Oxford, Ohio		Yost & Packard	Grace E. Derby	[illegible]			
Peoria Public Library, Peoria, Ill.		Richardson & Salter	E. S. Willcox	[illegible]*	[illegible]		
Appellate Court Library, Mt. Vernon, Ill.			A. C. Millspaugh	[illegible]*			
Sault Ste. Marie Public Library, Sault Ste. Marie, Mich.		J. C. Teague	Adah L. Shelly	[illegible]	[illegible]		

WESTERN STATES

Building	Page	Architect	Librarian	Year Com.	Cost	Cubic Foot Contents	Cost per Cu. Ft.
University of Missouri Lib., Columbia, Mo.		James P. Jamieson	Professor H. O. Severance	[illegible]	$200,000	[illegible]	[illegible]
Multnomah County Public Library, Portland, Ore.	201	Doyle, Patterson & Beach	Mary F. Isom	[illegible]	[illegible]	[illegible]	[illegible]
St. Paul Public Library, St. Paul, Minn.	221	Electus D. Litchfield	Wm. Dawson Johnston	1915			

* Of non-fireproof construction

WESTERN STATES—*Continued*

Building	Page	Architect	Librarian	Year Completed	Cost	Cubic Feet Contents	Cost per Cu. Ft.
Denver Public Library, Denver, Colo.	208	Albert Randolph Ross	Chalmers Hadley	19[illegible]	$[illegible]	[illegible]	$.[illegible]
Arkansas State Capitol Law Library, Little Rock, Ark.	210	Cass Gilbert	Peyton D. English	[illegible]	$[illegible]		
Supreme Court and Library Building, Salem, Ore.	218	A. C. Knighton	Edna M. Hawkes	1914	$[illegible]	797,000	$.28
University of Oregon Library, Eugene, Ore.		W. C. Knighton	M. H. Douglas	1913	$[illegible]	[illegible]	$.[illegible]
Washington University Medical School, St. Louis, Mo.		Dubuque & Link	Mrs. Helen Fischer	[illegible]			
Sioux City Public Library, Sioux City, Iowa		Edward L. Tilton	Jeanette M. Drake	1912	$[illegible]	[illegible]	$.[illegible]
Iowa State Teachers College, Cedar Falls, Iowa	230	Proudfoot, Bird & Rawson	Edna D. Bonsall	[illegible]	$[illegible]	[illegible]	$.21
Mercantile Library, St. Louis, Mo.		Mauran & Russell, Architects of Louisiana	W. F. R. Gifford				
Iowa State University Law Building, Iowa City, Iowa	[illegible]	Proudfoot, Bird & Rawson	Morton L. Ferson	[illegible]	$[illegible]	[illegible]	$.[illegible]
Kansas State Agricultural College, Manhattan, Kan.		Seymour Davis	Arthur B. Smith	1904*			
Leland Stanford, Jr. University Library, Stanford University, Cal.		Chas. Edward Hodges	Geo. T. Clark	1900*			
Linn County Branch Library, Kansas City, Mo.	251	Charles A. Smith	Purd B. Wright	1911	$[illegible]	124,000	$.26
School of Mines and Metallurgy, Rolla, Mo.		Howe, Hunt & Cutler	Jessie Cunningham	1912			
University of Missouri Library, Columbia, Mo.		James P. Jameson		1911	$[illegible]	77,043	$.17
South Dakota State College of Agriculture and Mechanic Arts, Brookings, S. D.			W. H. Powers	1904		181,500	
Coleraine Public Library, Coleraine, Minn.		Geo. F. O. Conover	Jessie B. Bollinger				
Wallace Public Library, Wallace, Idaho		Julius P. Zettel	Mrs. A. R. Carpenter	1911			
Academy of Idaho, Pocatello, Idaho			Gretchen Louise Smith	*			

CANADA

Building	Page	Architect	Librarian	Year Completed	Cost	Cubic Feet Contents	Cost per Cu. Ft.
Legislative Library, Toronto, Ontario	241	Geo. W. Gouinlock	Aven Parlow	19[illegible]	$[illegible]	1,650,000	$.15
Provincial Library, Victoria, British Columbia	242	F. M. Rattenbury	F. O. S. Schofield	[illegible]	$[illegible]	[illegible]	$.68
Provincial Library, Edmonton, Alberta	36	J. Chalmers, Structural Engineer	John Blue				
Saskatchewan Legislative Library, Regina, Sask.		Edward and W. S. Maxwell	John Hawks	1912			
Bibliothèque St. Sulpice, Montreal, Quebec	98	Eugene Payette	Aegidius Fauteux	1913	$285,000	950,000	$.30
Toronto Public Reference Library, Toronto, Ont.	246	Wickson & Gregg and A. H. Chapman	Geo. H. Locke	1909	$260,000	1,092,200	$.24
Knox College Library, Toronto, Ont.		Chapman & McGiffin	Rev. Edward Cockburn	1911	$[illegible]	[illegible]	$.52
McGill University Medical Lib., Montreal, Quebec		Brown & Vallance	Miss M. R. Charlton	1910	$[illegible]	17,143	$.45
Victoria College Library, Toronto, Ont.	[illegible]	Sproson & Rough	A. L. Laing	1909*	$[illegible]	[illegible]	$.[illegible]
Ottawa Public Library, Ottawa, Ont.	248	Edgar L. Horwood	Wm. J. Sykes	1909*	$[illegible]		
Hamilton Public Library, Hamilton, Ont.		A. W. Peene	Adam Hunter	1912			
Calgary Public Library, Calgary, Alberta		MacLean & Wright and Hodgson, Bates & Butler	Alexander Calhoun	1912*	$100,000	296,784	$.38
Moose Jaw Public Lib., Moose Jaw, Sask.	226	Reid & McAlpine	A. H. Gibbard	1913*	$[illegible]	201,000	$.40
Regina Public Library, Regina, Sask.	[illegible]	Storey & Van Egmond	J. R. C. Honeyman	1912	$50,000	225,000	$.23
Calgary Court House Law Library, Calgary, Alberta		Richard R. Blakey, Provincial Architect	Mrs. G. H. Norton	1913			
Edmonton Court House Law Library, Edmonton, Alberta		Richard R. Blakey, Provincial Architect	Lena Smith, L. L. A.				
Fort William Public Lib., Fort William, Ont.		Hood & Scott	Miss M. J. L. Black	1911			
Tillsonburg Public Lib., Tillsonburg, Ont.		W. A. Mahoney					

FOREIGN

Building	Page	Architect	Librarian	Year Completed	Cost	Cubic Feet Contents	Cost per Cu. Ft.
Library of Hawaii, Honolulu, T. H.	227	Henry D. Whitfield—H. L. Kerr, Supervising Architect	Miss E. J. Allen	1914	$101,000	119,000	$.25
Philippine Library, Manila, P. I.			James A. Robertson, Dir.				
Dairen Public Library, Dairen, Manchuria				1913			
Bureau of Education, Manila, P. I.			Frank R. White, Director				
Parliamentary Library, Wellington, New Zealand		John Campbell, Government Architect					
Sydney Public Library, Sydney, New South Wales			F. M. Bladen, F. R. G. S.				

* Old non-fireproof construction

LIBRARY BUILDINGS, PLANS AND INTERIORS

MONUMENTAL LIBRARIES

COLLEGE, SCHOOL AND SEMINARY LIBRARIES

PUBLIC LIBRARIES

PARLIAMENTARY AND STATE LIBRARIES

SOCIETY AND INSTITUTE LIBRARIES

All buildings illustrated have been equipped with Snead Stacks

Owing to the necessity of limiting the size of this book it has proved impracticable to illustrate more than a small part of the material available. Consequently some of the most important buildings have been omitted in order to show a variety of typical examples and to give representation to different localities.

MONUMENTAL LIBRARIES

LIBRARY OF CONGRESS

NEW YORK PUBLIC LIBRARY

COLUMBIA UNIVERSITY LIBRARY

WIDENER MEMORIAL LIBRARY

FIG. 138.

LIBRARY OF CONGRESS, WASHINGTON, D. C.

BERNARD R. GREEN, Engineer — SMITHMEYER & PELZ and E. P. CASEY, Architects — HERBERT PUTNAM, Librarian

LIBRARY OF CONGRESS, WASHINGTON, D. C.

SMITHMEYER & PELZ and EDWARD P. CASEY, Architects, BERNARD R. GREEN, Engineer

HERBERT PUTNAM, Librarian

AN ACT of Congress, passed April 15, 1886, authorized the construction of a library building substantially according to the plan submitted by John L. Smithmeyer, with such modifications as might be found necessary or advantageous. The original designs for the building were furnished by John L. Smithmeyer and Paul J. Pelz, and the architectural details were worked out by Paul J. Pelz and Edward P. Casey.

The construction of the building was under the direction of a commission until October, 1888, when, before the foundations were laid, the commission was abolished by Congress and the work placed under the control of General Thomas L. Casey, the Chief of Engineers of the Army. He placed Bernard R. Green in charge as superintendent and engineer, who upon the death of General Casey, March 25, 1896, succeeded to full control until the building was completed February 28, 1897, at the cost, exclusive of the land, of $6,344,585.34.

The building is approximately 470 feet by 340 feet and had originally four inner courts 150 feet by 75 feet to 100 feet, and it consists of cellar, basement, first, second and attic stories, with an octagonal dome rising 120 feet above the main roof. Later a ten-tier stack was constructed in the southeast court, the roof of this structure being carried directly on the steel frame of the stack.

The central feature is the main reading room, 100 feet in diameter, extending from the first floor to the inner dome, a distance of 125 feet and lighted through eight large arched windows in the clerestory. It has 240 desks, thirty-six alcove tables and can accommodate 250 readers at one time. In the alcoves are two tiers of metal shelving holding over 120,000 volumes. The distributing desk in the center of the reading room is connected with the three main stacks by pneumatic tubes and with the north and south stacks by mechanical book carriers.

Each stack has nine "decks" or floors, each 7 feet high. The dimensions and capacities of the stacks are as follows:

Location	Depth	Length	Height	Volumes capacity
North stack	44'8"	110'0"	65'0"	713,500
South stack	44'8"	110'0"	65'0"	713,500
East stack	44'8"	50'0"	65'0"	173,000
Southeast court stack	74'0"	150'0"	80'0"	1,045,000
Total capacity of four main stacks.				2,645,000

The Smithsonian room on the second floor is 131 feet by 35 feet and has a book stack of three tiers provided with an electric elevator. The capacity of this stack is about 150,000 volumes.

A three-tier stack has also been installed in the north curtain, second floor, for manuscripts and documents, the total capacity being 250,000 volumes. The westerly stacks in the first tier are enclosed with plate glass for greater security.

In the attic are rooms for photography, repair of prints and manuscripts, storage, a public restaurant, and a room containing a book stack of 80,000 volumes capacity for the Slavic section.

The music division occupies a portion of the north curtain in the basement story, with auxiliary bookstacks in the cellar directly below. It has a storage capacity of 12,840 feet of 13 inch deep shelving.

Outside of the three main stacks the basement story contains the reading room for the blind, the departments of music and copyrights, a branch of the Government Printing Office, the offices of the superintendent, chief clerk and the watch, and the mail room which handles all material arriving at or dispatched from the library building, including all mail matter and books delivered for outside use.

The building already contains over one hundred miles of shelving for books exclusive of that for prints, maps and charts.

The cellar space is devoted to the machinery room, heating apparatus, workshops and storage. The boilers and coal vaults are located under the parking, near but quite outside the building, at the east front.

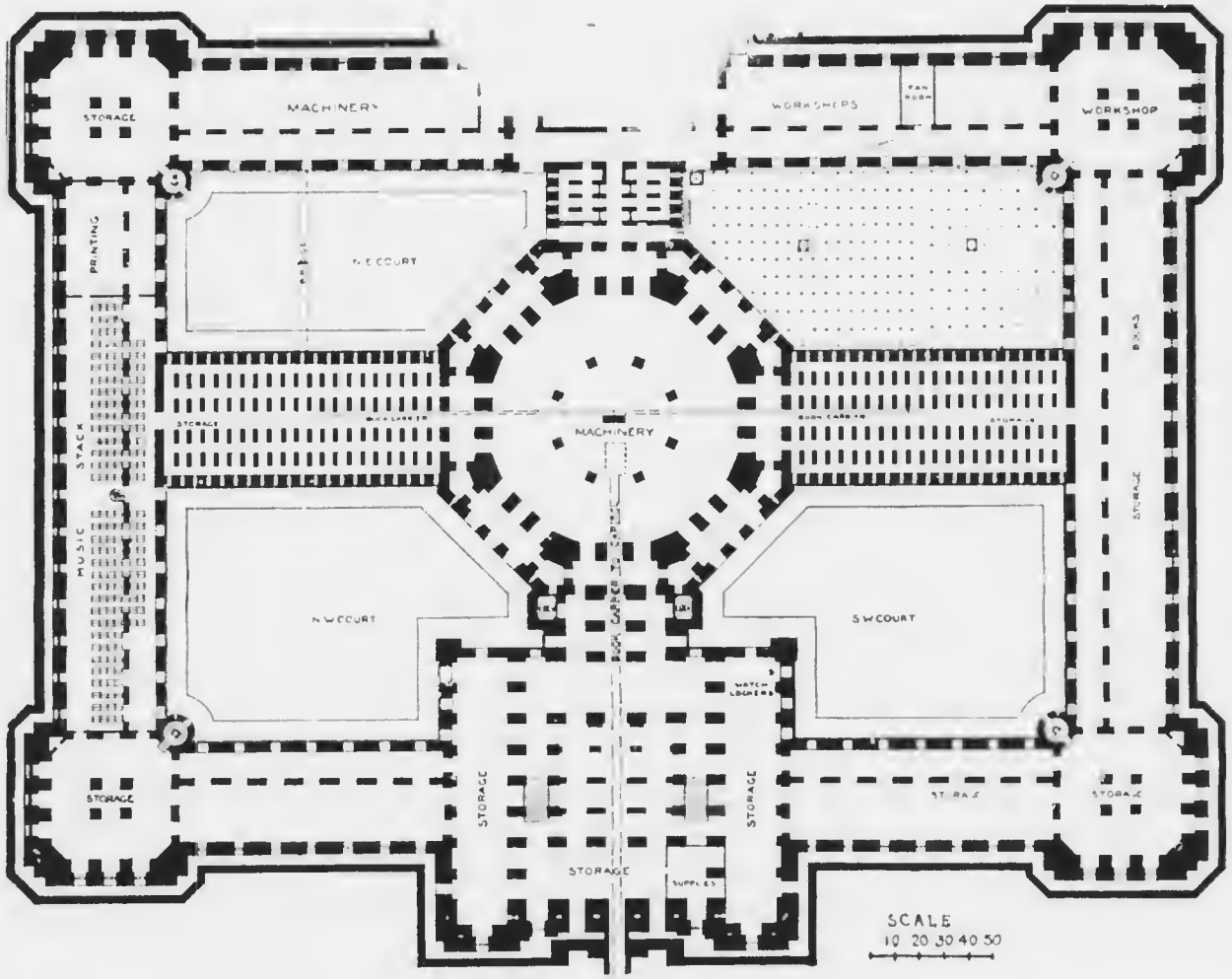


Fig. 139 CELLAR FLOOR PLAN, LIBRARY OF CONGRESS, WASHINGTON, D. C.

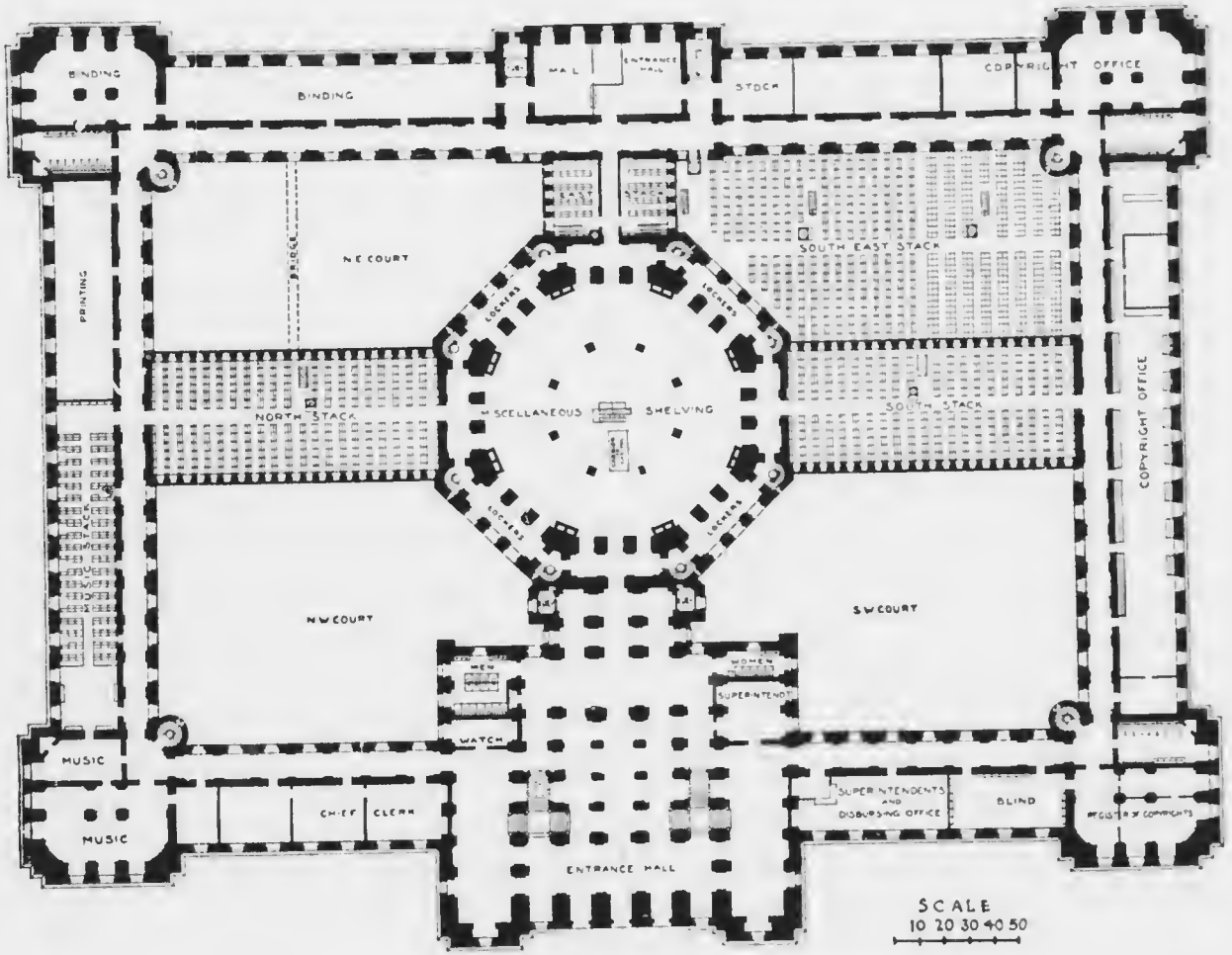


Fig. 110. BASEMENT FLOOR PLAN, LIBRARY OF CONGRESS, WASHINGTON, D. C.

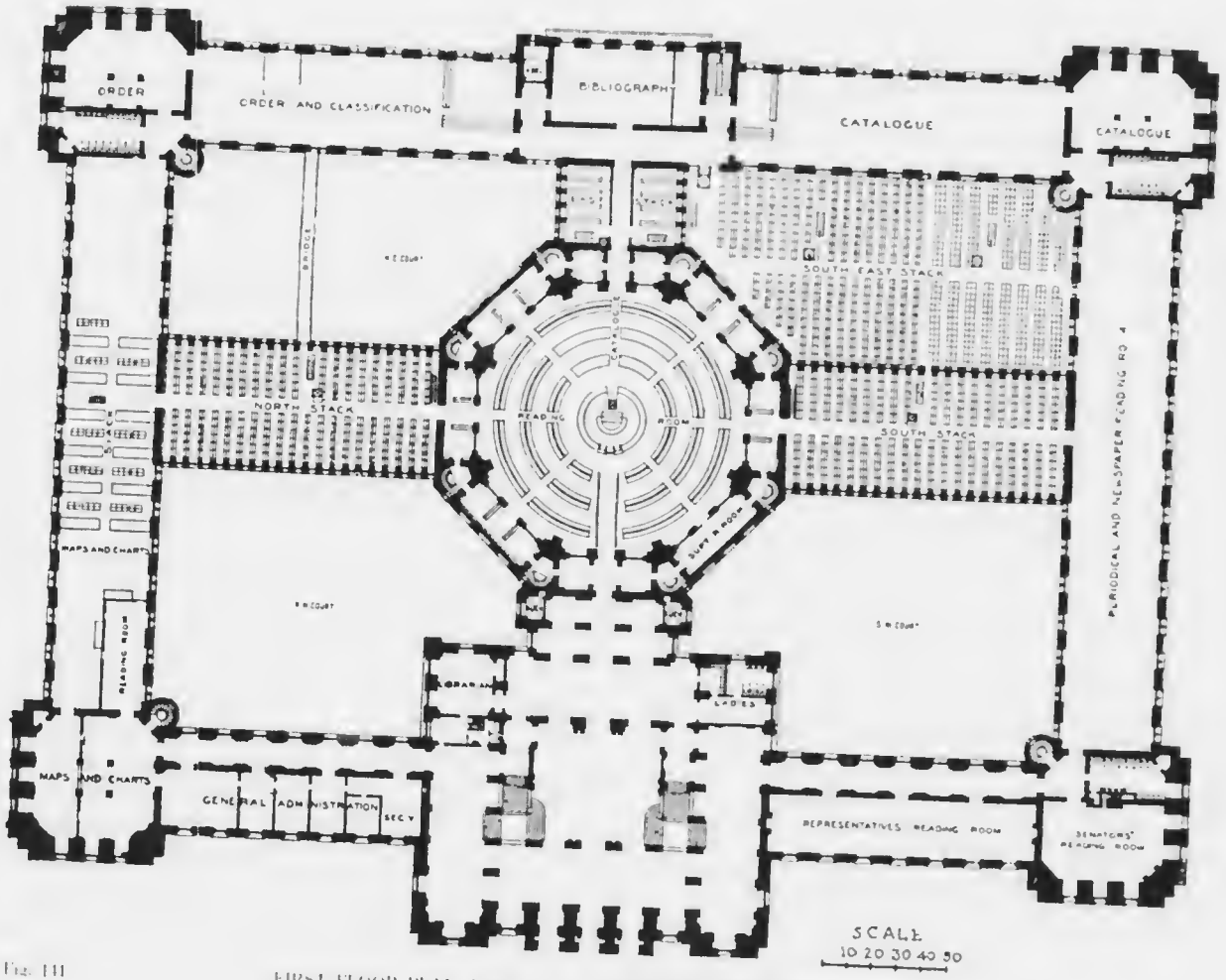


Fig. III

FIRST FLOOR PLAN, LIBRARY OF CONGRESS, WASHINGTON, D. C.

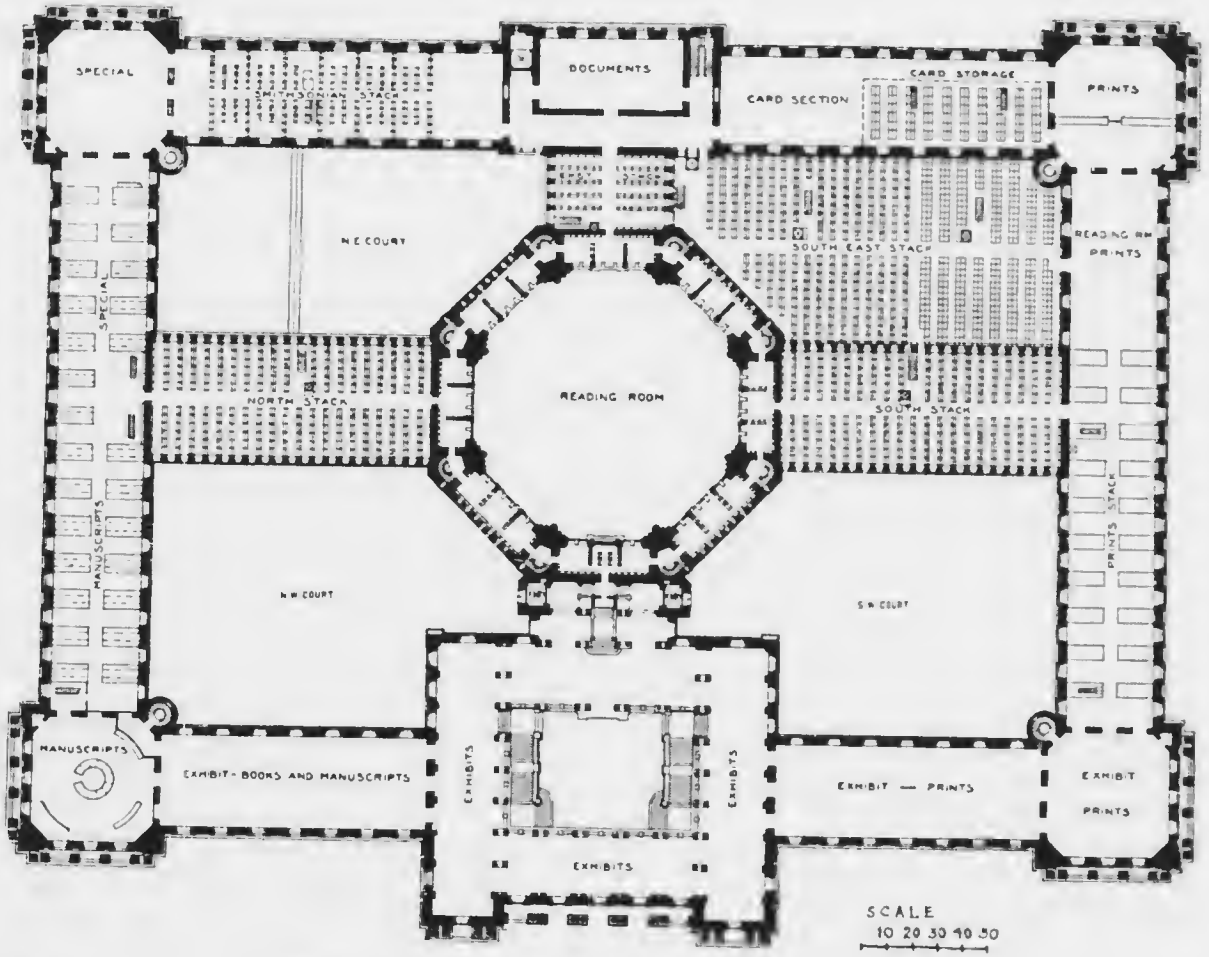


Fig. 112 SECOND FLOOR PLAN, LIBRARY OF CONGRESS, WASHINGTON, D. C.

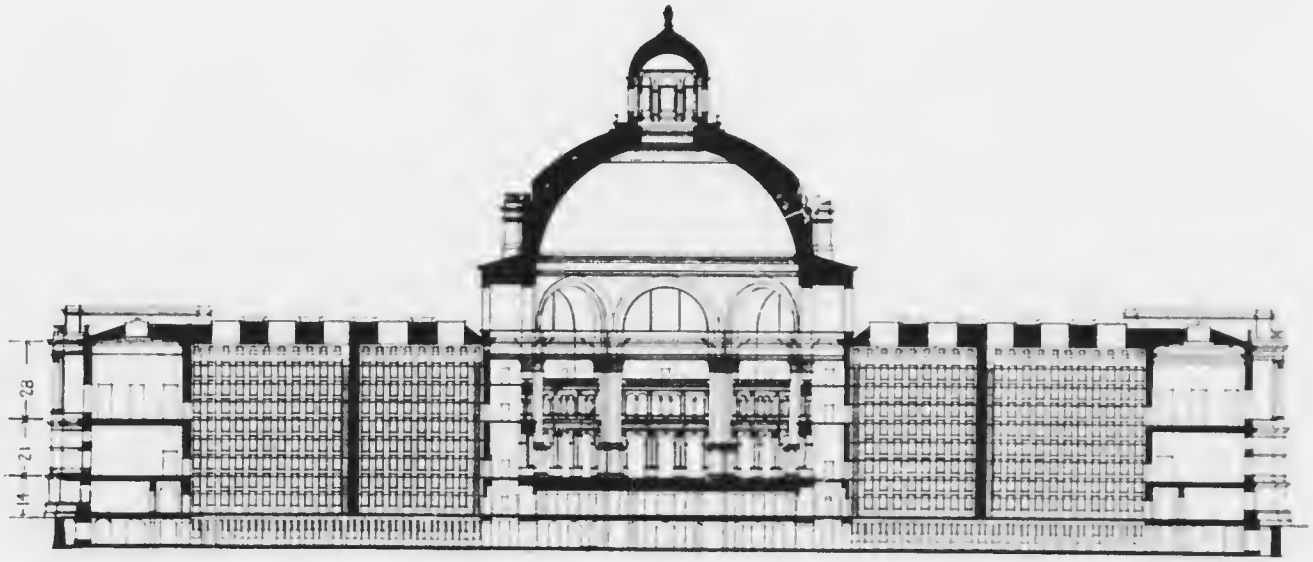


Fig. 143. SECTION THROUGH LIBRARY OF CONGRESS SHOWING THE NORTH AND SOUTH STACKS AND THE MAIN READING ROOM

The main story heights are in multiples of the stack tier heights (7'-0") which allows the stack deck floors to line up with the building floors.

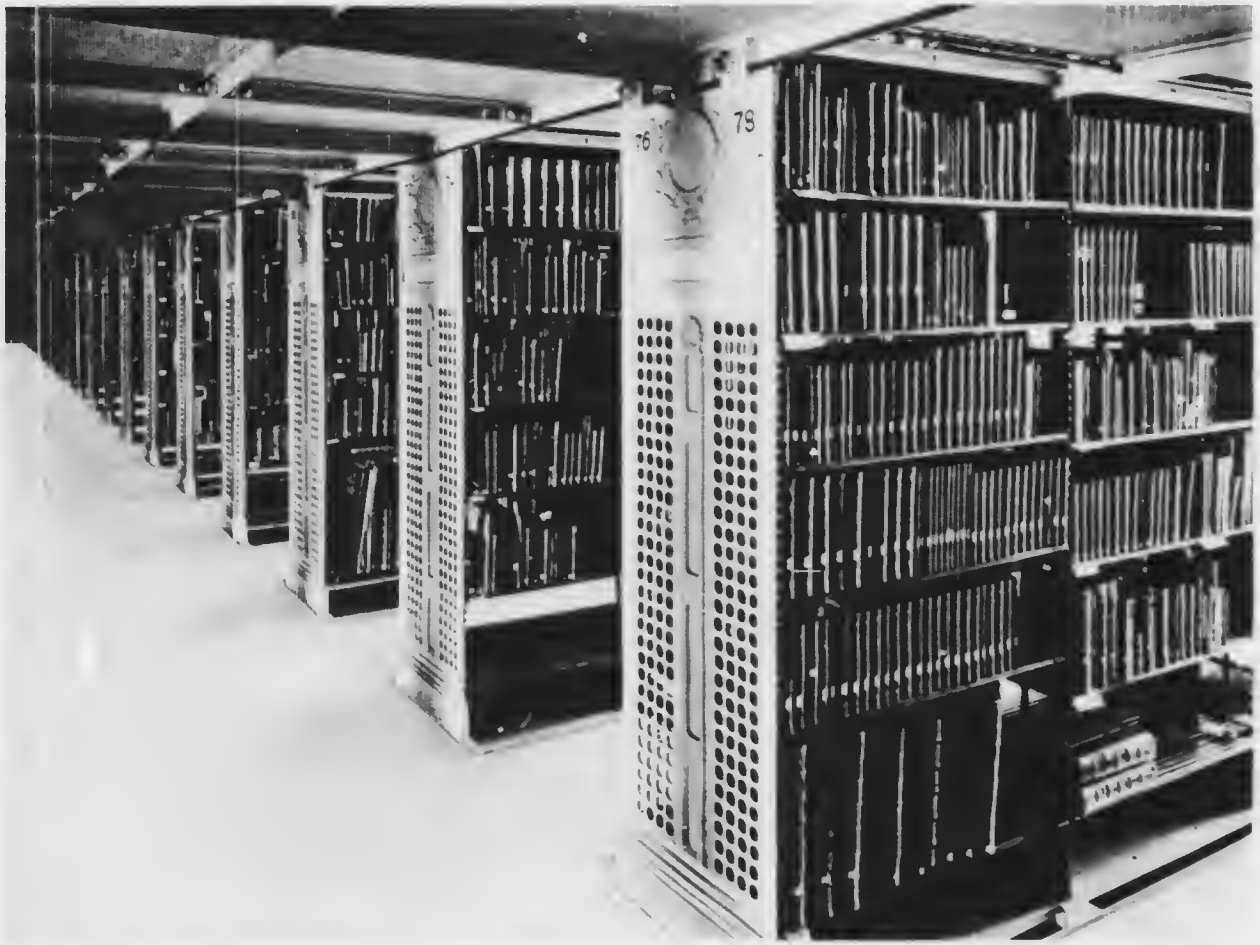


Fig. 141 A TYPICAL TIER IN ONE OF THE FOUR NINE-TIER SNEAD STANDARD STACKS, LIBRARY OF CONGRESS

Fig. 145.

Carrère & Hastings, Architects.

NEW YORK PUBLIC LIBRARY, FIFTH AVENUE FRONT

Edwin H. Anderson, Director

NEW YORK PUBLIC LIBRARY

Carrère & Hastings, Architects

John Shaw Billings, Late Director (deceased) — Lewis H. Anderson, Director

THE New York Public Library was founded on the 27th of May, 1895, by the consolidation of the Astor Library, the Lenox Library and the Tilden Trust. At that time a board of twenty-one trustees was elected from the boards of these three corporations, and provision was made for maintaining a free public library, with such branches as might be considered advisable.

The site chosen for the main building was the eastern end of Bryant Park on Fifth Avenue, between 40th and 42nd Streets, then occupied by the old reservoir. In 1897 the City of New York agreed to erect a building which was to be administered by the trustees, with certain restrictions as to time of opening and the maintenance of a circulating library. The city furnished both site and money for construction.

On November 14, 1897, the architects for the new building were selected in competition. The removal of the reservoir was begun in June, 1899 and on May 23, 1911, the building, completed at a cost of $9,466,566, was opened to the public.

To the librarian the most interesting features of the plan are: *First*, the placing of the main reading room on the top floor at the rear, immediately above the main stack room, its floor being supported by the stack uprights. This gives a well-lighted, well ventilated, quiet room conveniently located over the book "reservoir." *Second*, the arrangement and distribution of special reading rooms in such a way as to make the books shelved there easily available for use in the main reading room, and to allow unrestricted access to the books on the part of the investigators and special students. *Third*, the grouping of the administration rooms and offices on the south side of the building, leaving the east, north and west sides for reading rooms or storage of books.

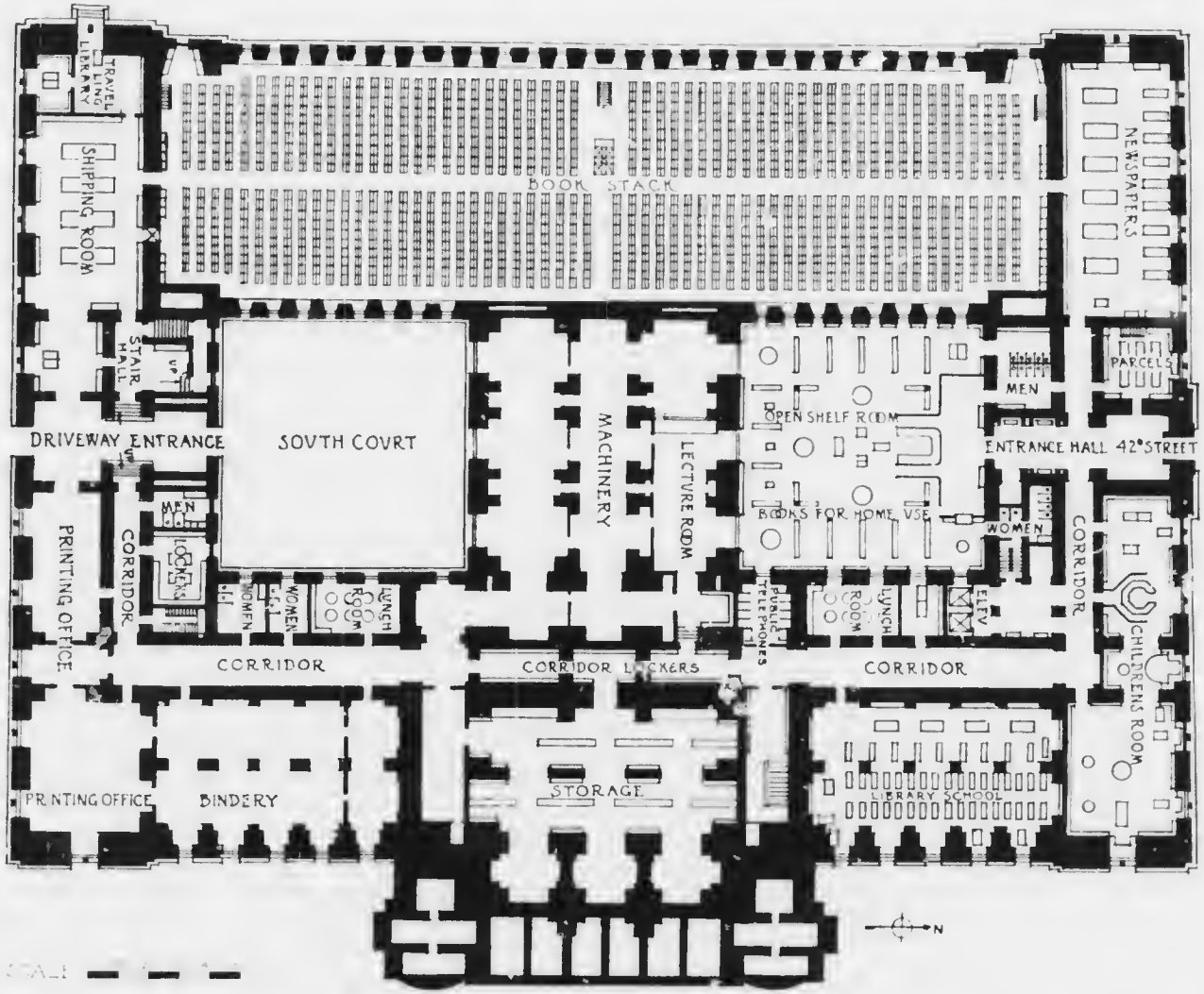
The building is in the form of a rectangle, 390 feet front by 270 feet deep. The heights of the floors are as follows: cellar, 13 feet; basement, 15 feet, first story, 22 feet 6 inches; second story, 16 feet; third story, ceiling height 11 to 23 feet; main reading room, 50 feet. The heights of the basement, first and second stories were made multiples of the stack tier height, 7 feet 6 inches, in order that the first, third and fifth stack decks might line up with the main floors of the building. The area covered by the library, exclusive of the open south court, is 115,000 square feet and its cubic contents is 10,380,000 cubic feet.

The material used is largely Vermont marble bonded in brick walls, steel beams with terra cotta arch floor construction, roof of copper and glass and window frames of bronze.

The main bookstack occupies the larger part of the rear of the building and extends upward through the basement, first and second stories. It is 297 feet long, 78 feet wide, and is made up of seven tiers, each 7 feet 6 inches high, with deck floors of 1½ inch marble.

Each stack tier is divided into four quadrants designated as Northwest, Northeast, Southwest and Southeast. Each section consists of twenty-nine double-faced ranges, composed of ten compartments with six adjustable and one fixed shelf in each compartment. Along the walls are compartments 24, 26 and 30 inches deep, fitted with sliding shelves. In all the main stack contains 95,000 adjustable and 16,000 fixed shelves, which placed end to end would extend a distance of 63.3 miles. The capacity of this big stack is about 3,000,000 volumes. In forty-three other rooms in the basement, first, second and third stories Snead bookstacks are provided with a combined capacity of 500,000 volumes, making the total stack capacity about 3,500,000 volumes.

The main reading room is 76 feet by 295 feet, and accommodates about 800 readers. In the center is the delivery department having pneumatic tubes and four electric elevators connecting it with the different levels of the stack room below, while auxiliary elevators are placed at each end of the stack. A pneumatic tube service connects the main reading room with all rooms in which there are special collections.



SCALE

Fig. 116. BASEMENT FLOOR PLAN, NEW YORK PUBLIC LIBRARY

Fig. 116. BASEMENT FLOOR PLAN, NEW YORK PUBLIC LIBRARY

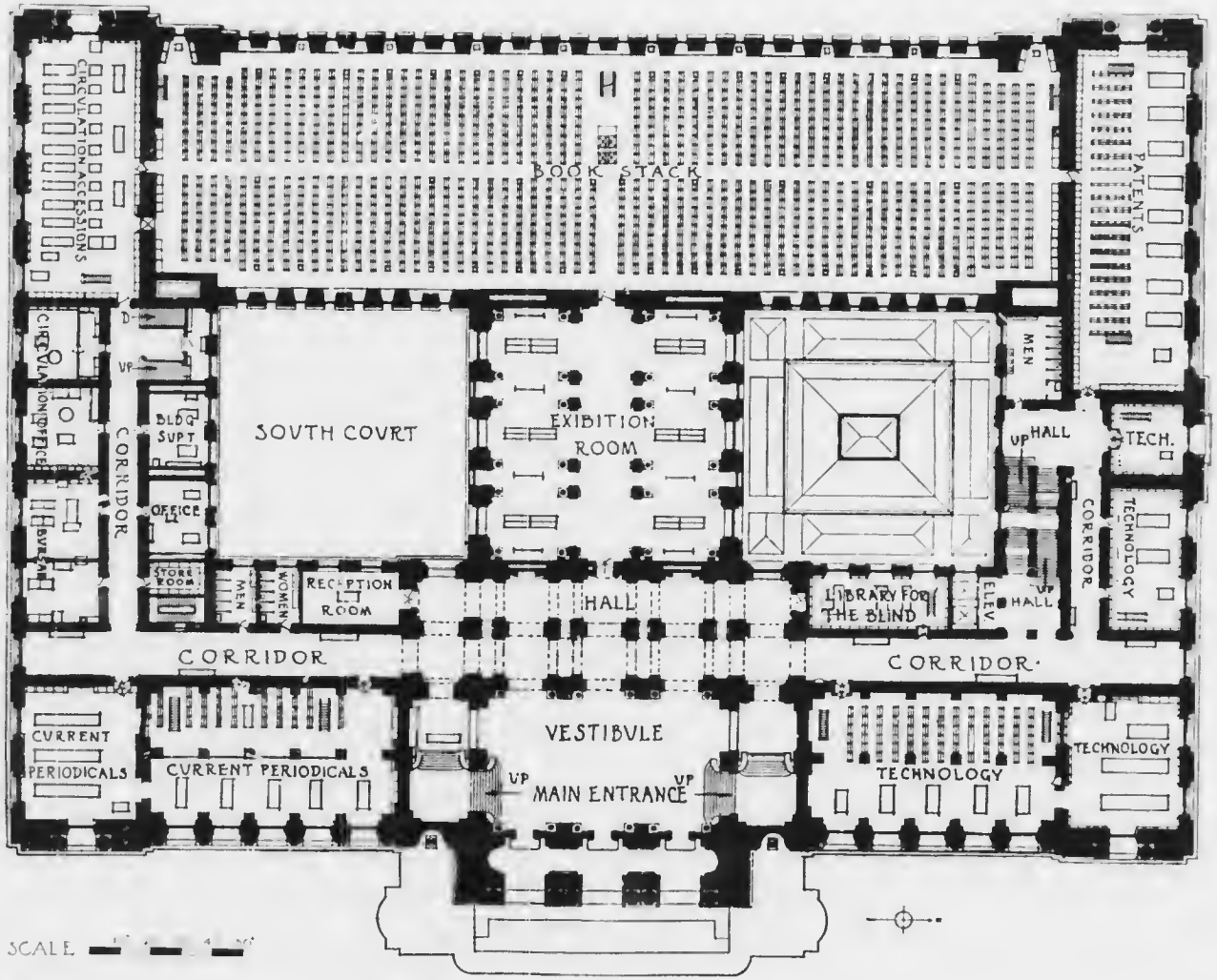


Fig. 117 FIRST FLOOR PLAN, NEW YORK PUBLIC LIBRARY

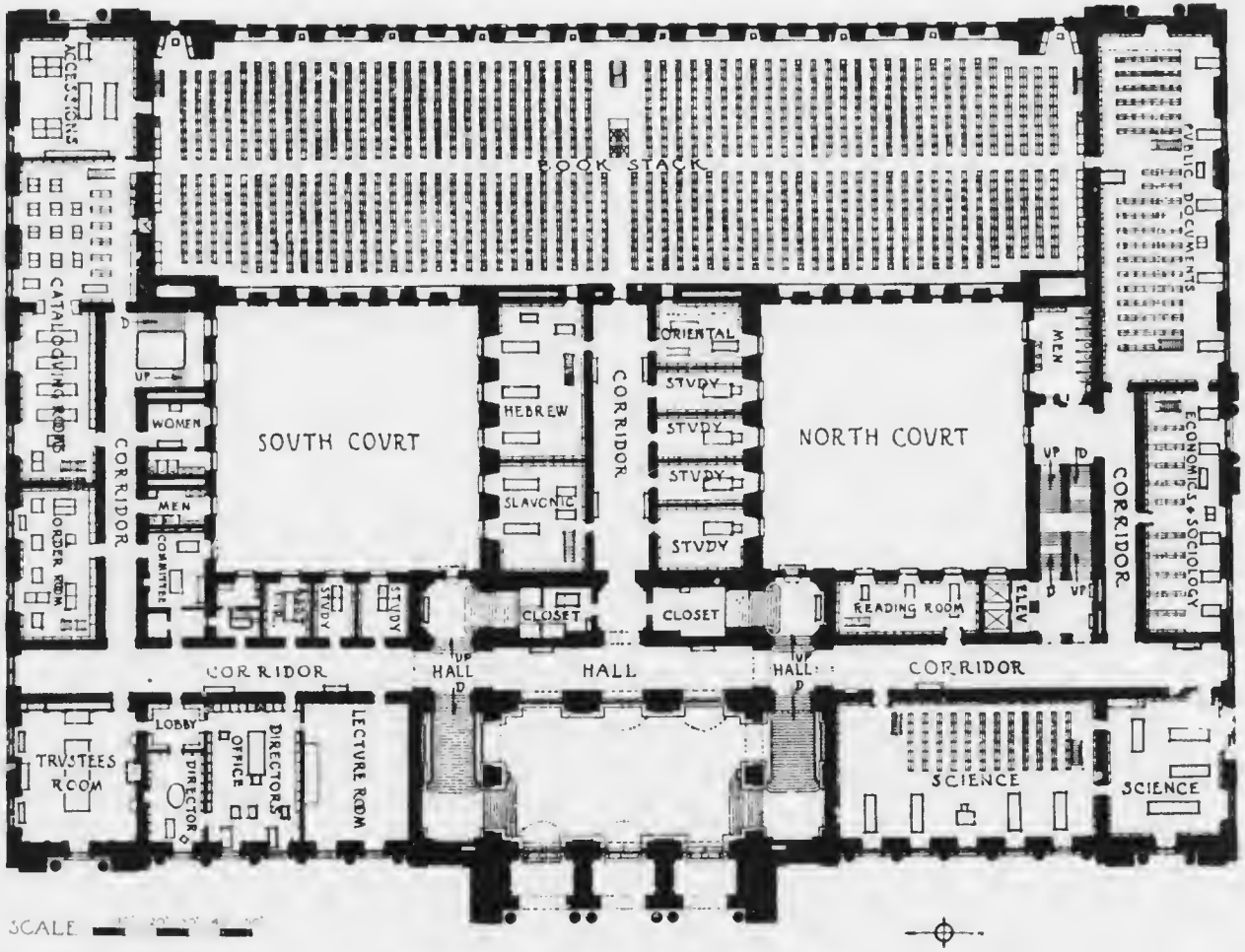


Fig. 148. SECOND FLOOR PLAN, NEW YORK PUBLIC LIBRARY

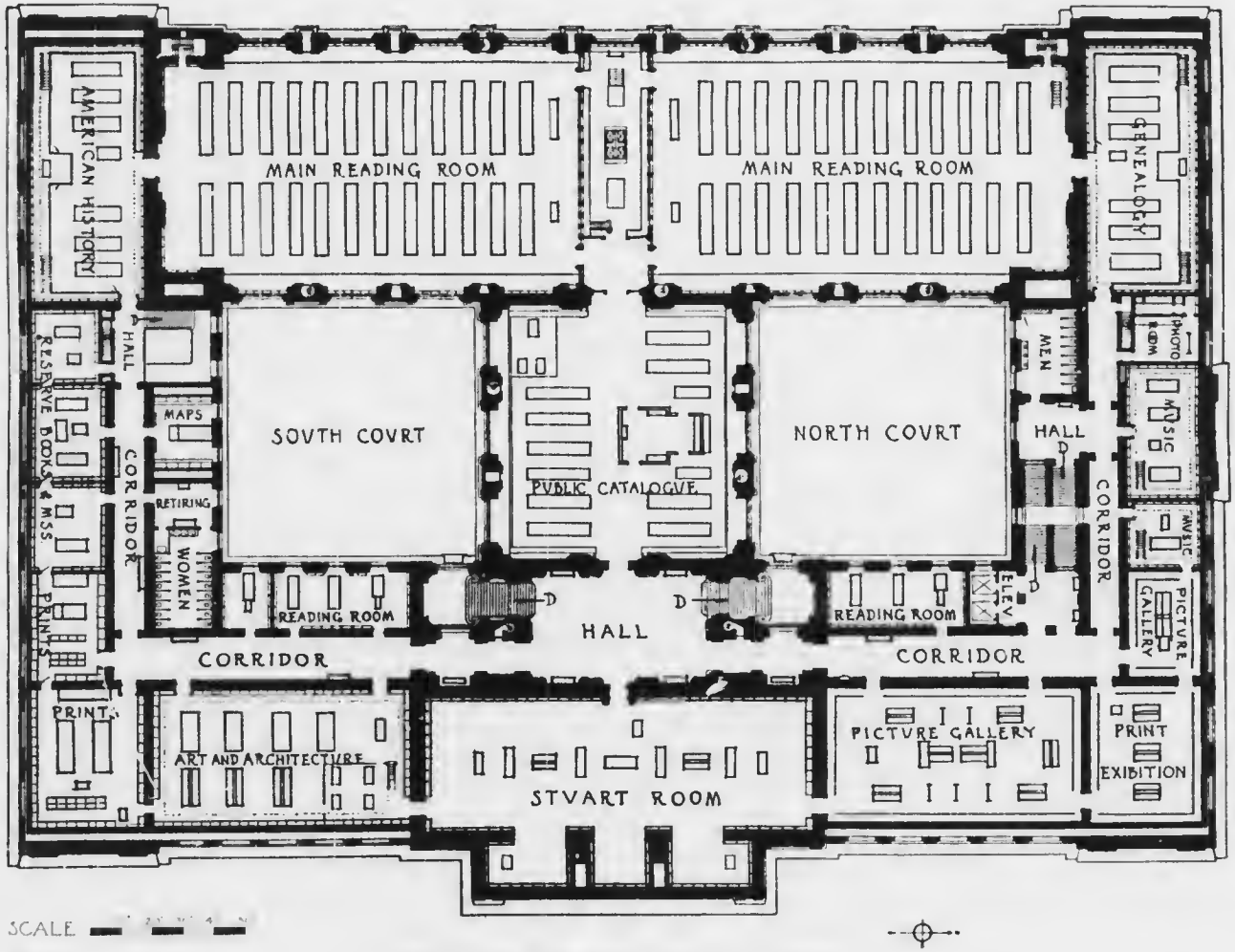


Fig. 149. THIRD FLOOR PLAN, NEW YORK PUBLIC LIBRARY

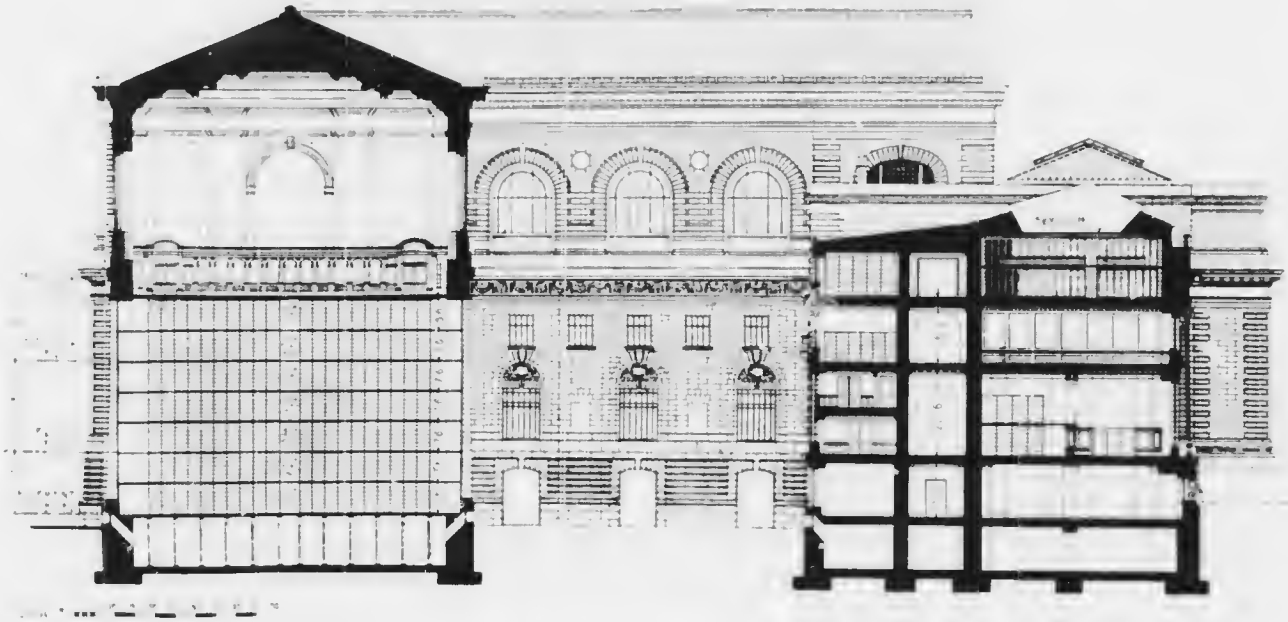


Fig. 150 TRANSVERSE SECTION, NEW YORK PUBLIC LIBRARY

The section shows the main reading room carried by the seven tier Snead Standard Stack. Story heights are even multiples of the stack tier heights.

Fig. 151. MAIN READING ROOM, NEW YORK PUBLIC LIBRARY

This room, divided in the center by the delivery space, accommodates about 800 readers. Wall shelving in the room affords space for 25,000 volumes. Directly below the reading room is the main stack room with a capacity of 3,000,000 volumes.

Fig. 152. TYPICAL VIEW IN MAIN STACK ROOM, SEVEN TIER SNEAD STANDARD STACK, NEW YORK PUBLIC LIBRARY

Fig. 152. TYPICAL VIEW IN MAIN STACK ROOM, SEVEN TIER SNEAD STANDARD STACK, NEW YORK PUBLIC LIBRARY

Fig. 153. GENEALOGY ROOM, NEW YORK PUBLIC LIBRARY

Snead Standard Stack, with gallery lining all four walls.

Fig. 151 COLUMBIA UNIVERSITY LIBRARY NEW YORK CITY

McKim, Mead & White, Architects

Frederick C. Hicks, Acting Librarian

This building forms the central member of the university group and was originally designed to include administration offices and class rooms which, as the library grows, are being moved into other buildings. The books are stored mainly on the seminar plan.

are being moved into other buildings. The books are stored mainly on the seminar plan

Fig. 155. COLUMBIA UNIVERSITY LIBRARY, NEW YORK CITY

Snead Standard Stack in one of the third floor seminar rooms.

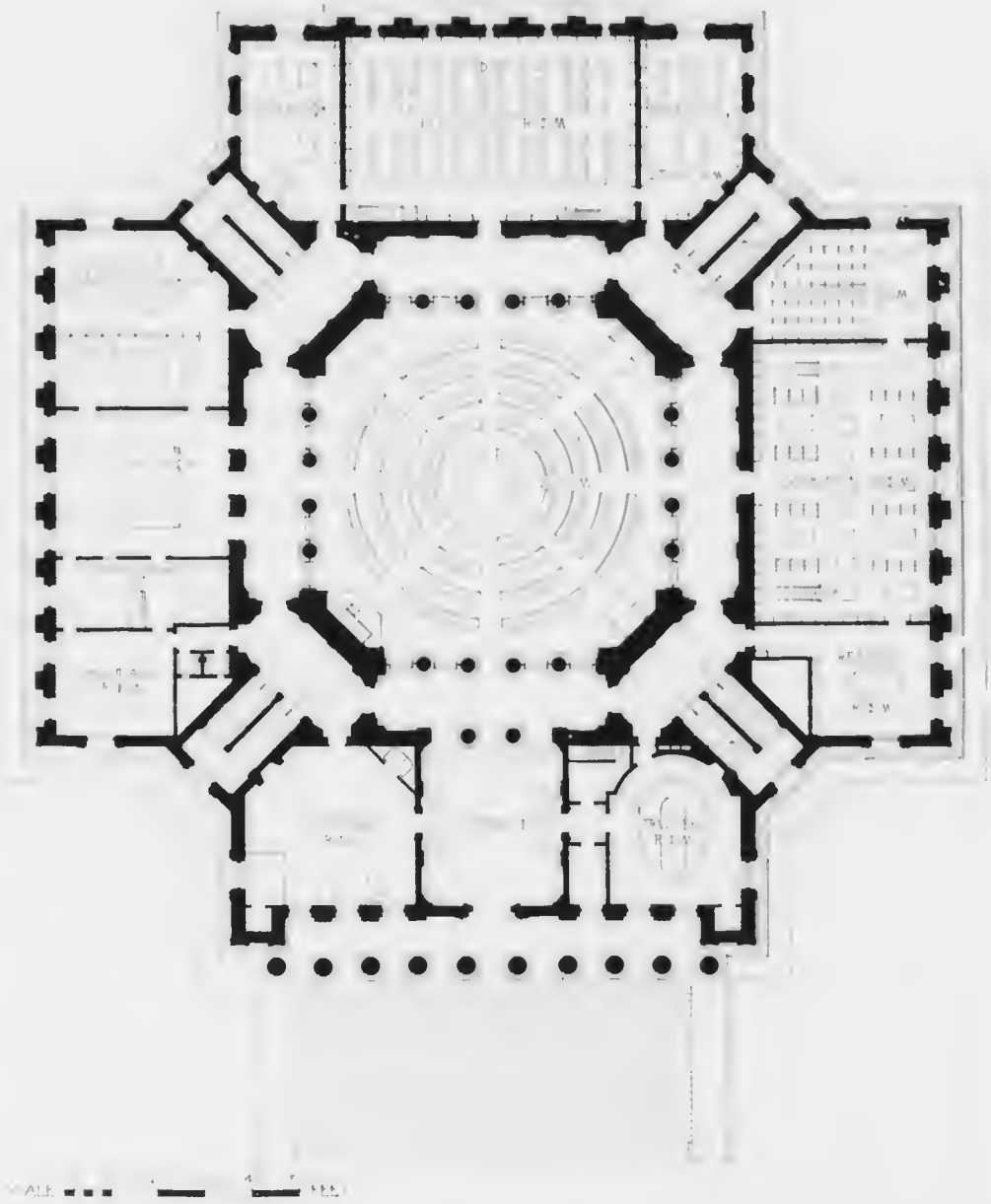


Fig. 156. FIRST FLOOR PLAN, COLUMBIA UNIVERSITY LIBRARY, NEW YORK CITY

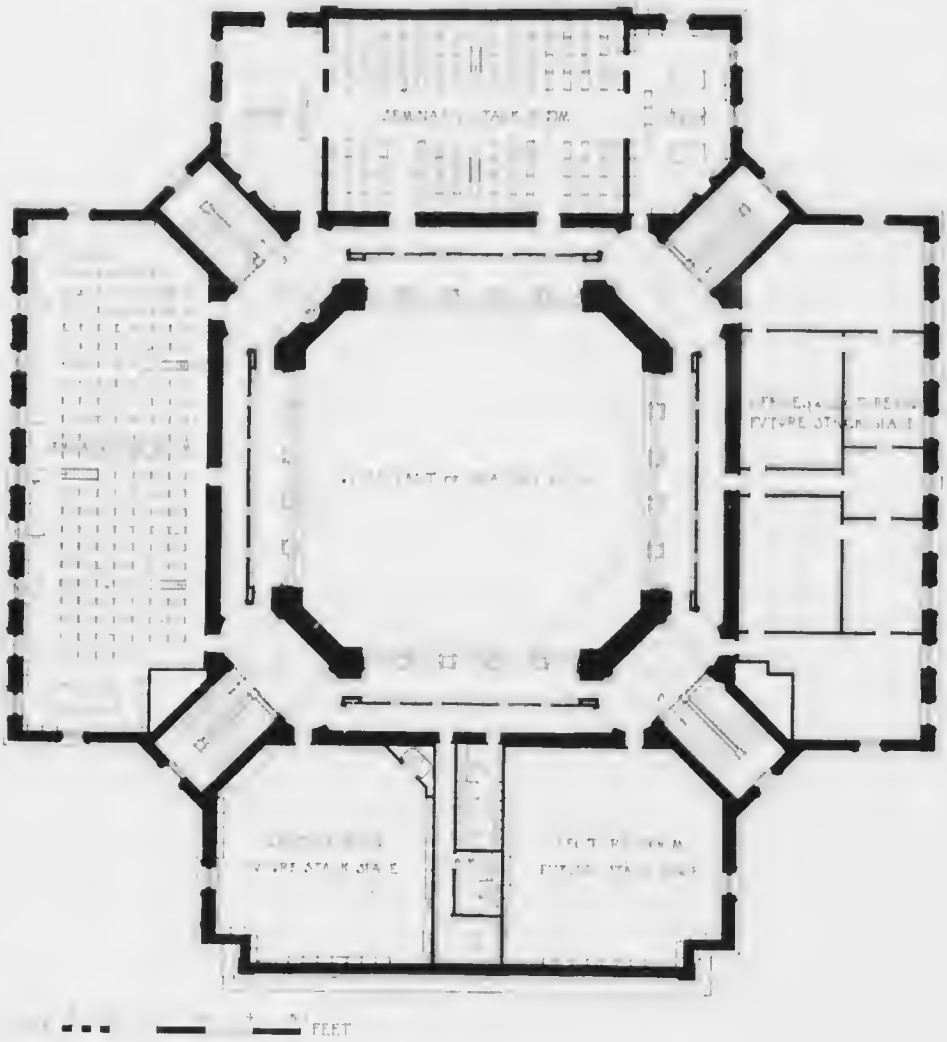


Fig. 157. THIRD FLOOR PLAN, COLUMBIA UNIVERSITY LIBRARY, NEW YORK CITY

Fig. 158 HARRY ELKINS WIDENER MEMORIAL LIBRARY, HARVARD UNIVERSITY, CAMBRIDGE, MASS.

HORACE TRUMBAUER, Architect *Photograph of model* WILLIAM COOLIDGE LANE, Librarian

The height of each story corresponds to the height of two or three stack floors

THE HARRY ELKINS WIDENER MEMORIAL LIBRARY, HARVARD UNIVERSITY, CAMBRIDGE, MASS.

Horace Trumbauer, Architect

William Coolidge Lane, Librarian

THE Harry Elkins Widener Memorial Library, completed during the year 1915, houses the principal book collection of Harvard University, as well as the precious group of rare and wonderfully interesting books brought together by Mr. Widener. It stands, in part, on precisely the same spot as old Gore Hall, a building which for seventy-five years sheltered the richest and most widely used collection of college books in America. The new building faces inward towards the college grounds, forming one side of a quadrangle, the other three sides of which are occupied by University buildings.

From the rear of the entrance hall on the first floor, monumental stairs lead to the second floor which contains the main reading room overlooking the college grounds. This room, accommodating 336 readers, is 192 feet by 40 feet and extends 43 feet to the roof. The other three sides of the building, however, contain a third floor of special collection and seminar rooms which rest directly on and are carried by the bookstack below. The stack, extending across the rear and along the greater part of both sides of the building, contains ten tiers with a total capacity of 2,206,000 volumes. Vertical deck slit construction with wide, fixed bottom shelves and protected openings is employed on all deck floors. The inconvenience and unsightly appearance of vents, ducts and pipes carried through the book stack is eliminated by the provision of an open space of about three feet, between the first and second tiers, through which all these conductors are carried.

The stack room is ventilated in a simple and economical manner by means of plenum fans forcing fresh, properly heated air into the basement and exhaust fans drawing the partially vitiated air out from the top.

One of the distinguishing features of the stack is a row of stalls along each outside wall, each stall being well lighted and having comfortable room for a table and chair. The stack thus becomes practically a working laboratory, with the best possible accommodations for individual and continuous work. A striking innovation is found in the provision of a large number of small study-rooms about 10 feet by 12 feet, or 12 feet by 15 feet for the private use of professors and others. These are provided in five tiers. Although these study-rooms open into the stack, some of them are separated from it by a screen, thus allowing students and visitors access to the rooms, without passing through the stack proper.

Other studies are provided in different parts of the building, the total number being seventy-four. The upper floor contains fourteen studies, nineteen rooms to be used for special libraries and seminars, a photographing room, the Library's collection of maps and manuscripts and many of the special collections such as the Classical Library and the Child Memorial Library, which were formerly in other buildings. The building contains thirty-six miscellaneous rooms equipped with Snead Steel Shelving.

As the center of the building was reserved for the Widener books, the delivery room was placed to one side. This was deemed permissible since, in a college library, the greater part of the students find the books necessary for daily work in the reading room, while advanced students and officers have direct access to the shelves and in most cases prefer to look up their own books and work in the stack rather than to call for books at the delivery desk. These conditions greatly reduce the proportion of books issued from the desk. The grouping of the reading room, reference books, card catalog and delivery desk, all in close juxtaposition, but separate one from another, is a great advantage.

Ease of communication between the different floors and departments is facilitated by telephones, pneumatic tubes, book lifts, book conveyors and passenger elevators.

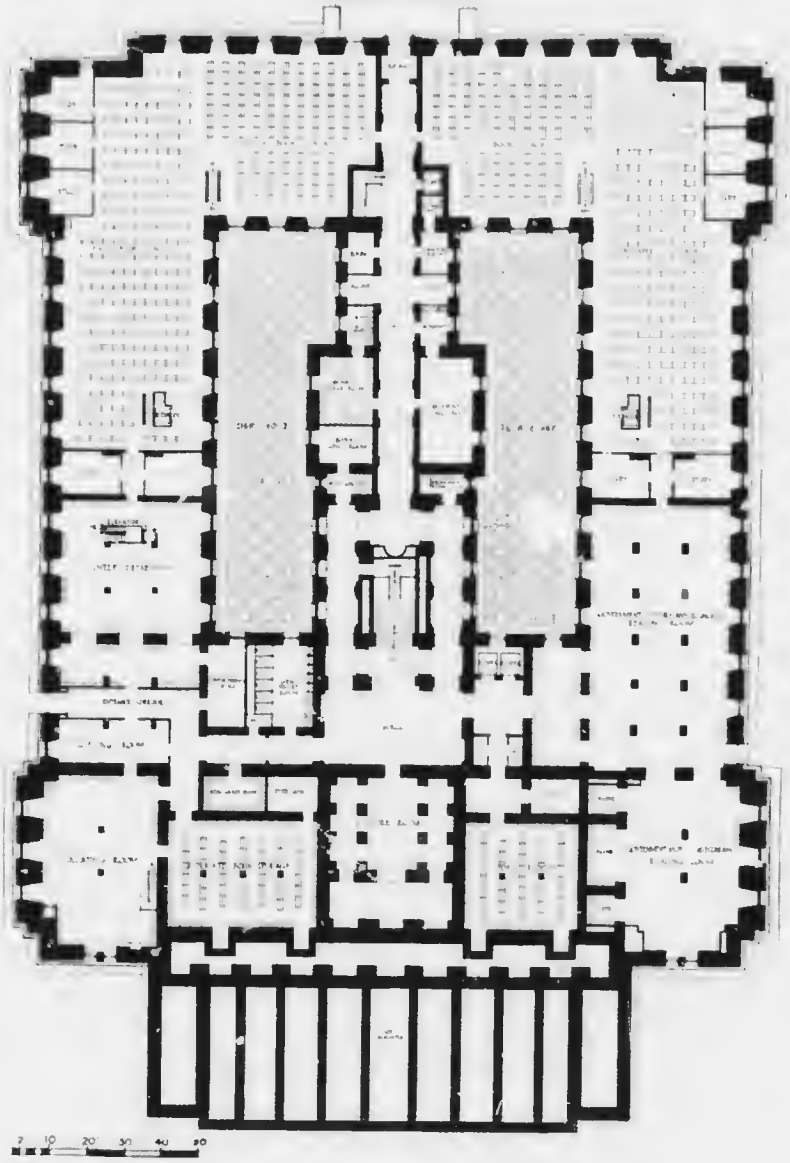


Fig. 159 BASEMENT FLOOR PLAN, WIDENER MEMORIAL LIBRARY HARVARD UNIVERSITY

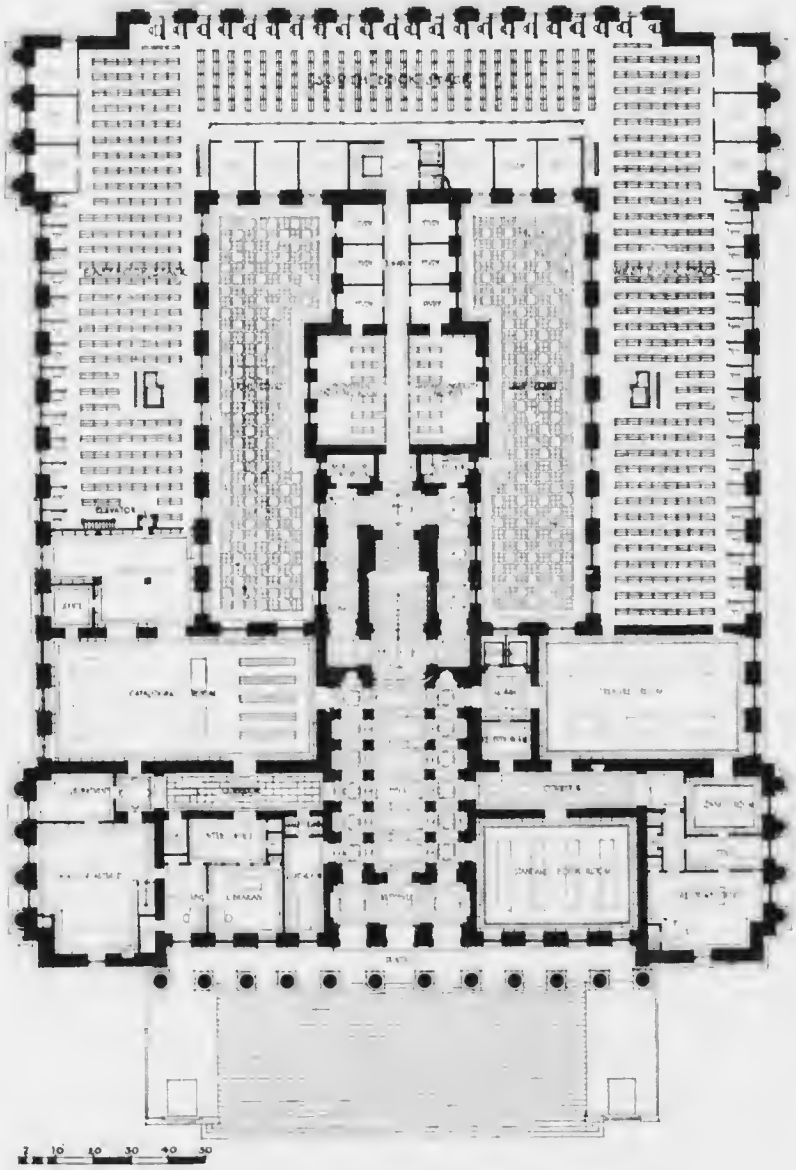


Fig. 160. FIRST FLOOR PLAN, WIDENER MEMORIAL LIBRARY, HARVARD UNIVERSITY

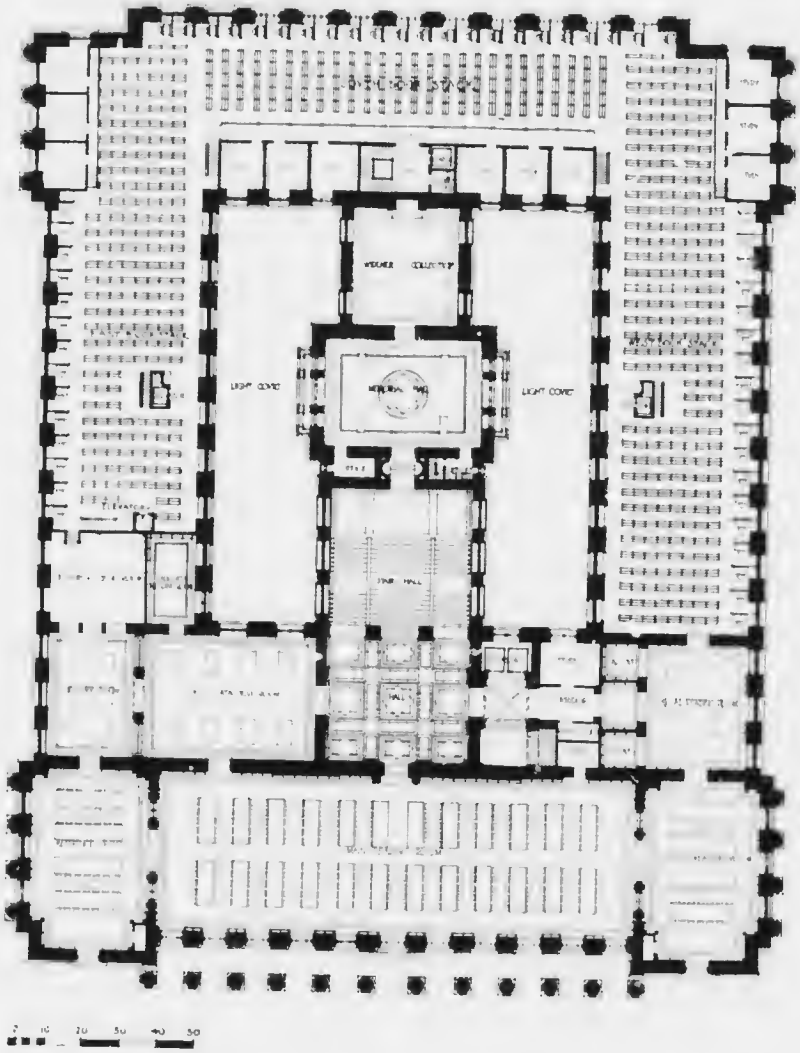


FIG. 161 SECOND FLOOR PLAN, WIDENER MEMORIAL LIBRARY
HARVARD UNIVERSITY

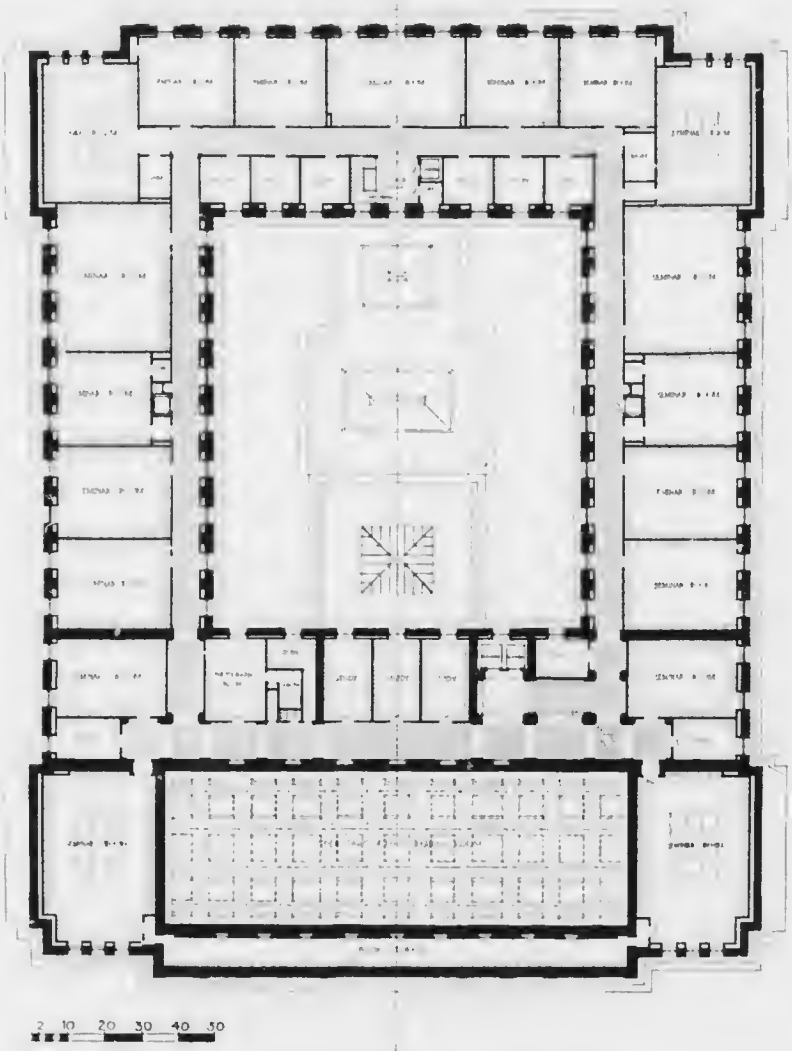


FIG. 162. THIRD FLOOR PLAN, WIDENER MEMORIAL LIBRARY, HARVARD UNIVERSITY

Fig. 163.

WIDENER MEMORIAL LIBRARY, CAMBRIDGE, MASS

Steel frame for ten-tier Snead Standard Stack, in course of construction. December 4, 1913. The main third floor of the building is carried on this stack framing

COLLEGE, SCHOOL AND SEMINARY LIBRARIES

GILMAN HALL, JOHNS HOPKINS UNIVERSITY
HARPER MEMORIAL LIBRARY, CHICAGO UNIVERSITY
UNION THEOLOGICAL SEMINARY
KENT HALL, COLUMBIA UNIVERSITY
ANDOVER HARVARD THEOLOGICAL SEMINARY
OHIO STATE UNIVERSITY LIBRARY
PURDUE UNIVERSITY LIBRARY
ST. CHARLES THEOLOGICAL SEMINARY
LINCOLN HALL, UNIVERSITY OF ILLINOIS
IOWA STATE TEACHERS' COLLEGE
KRAUTH MEMORIAL LIBRARY, MT. AIRY, PA.
INDIANA STATE NORMAL SCHOOL LIBRARY
HEBREW UNION COLLEGE LIBRARY
JEWISH THEOLOGICAL SEMINARY
WELLS COLLEGE LIBRARY
ST. ELIZABETH'S COLLEGE LIBRARY
DROPSIE COLLEGE LIBRARY
WILLIAMS MEMORIAL LIBRARY, TRINITY COLLEGE
DAVIS LIBRARY, PHILLIPS EXETER ACADEMY
VICTORIA COLLEGE LIBRARY, TORONTO
SCHAUFFLER MEMORIAL LIBRARY, MOUNT HERMON, MASS.
LOYOLA UNIVERSITY LIBRARY
VAN WICKLE MEMORIAL LIBRARY, LAFAYETTE COLLEGE
COAST ARTILLERY TRAINING SCHOOL LIBRARY
UNIVERSITY OF NORTH CAROLINA LIBRARY
IOWA STATE UNIVERSITY LAW LIBRARY
UNIVERSITY OF TENNESSEE LIBRARY

Fig. 164 GILMAN HALL, THE LIBRARY OF JOHNS HOPKINS UNIVERSITY, BALTIMORE, MD

PARKER, THOMAS & RICE, Architects

DR. M. LLEWELLYN RANEY, Librarian

The basement, ground, first, second and third floors, are on the same level as the bottom stack tier, second, fourth, sixth and eighth stack deck floors respectively

GILMAN HALL, BALTIMORE, MD.
THE JOHNS HOPKINS UNIVERSITY LIBRARY

PARKER, THOMAS & RICE, Architects

DR. M. LLEWELLYN RANEY, Librarian

GILMAN HALL, the new fireproof library of the Johns Hopkins University, was completed during the year 1914, at a total cost of about $600,000. It is the first of the major buildings to be erected at Homewood, where all departments of the University, except the Medical School, are to move.

Gilman Hall is the crown of the campus—marked so by its place at the head of the main quadrangle, by its architectural distinction, especially due to the portico and clock tower which rises to a height of 120 feet, by its size and by its function. The arrangement of the building is noteworthy because of the organization of the stack as a series of departmental libraries, planned in the first instance by the librarian who served as a secretary of the faculty committee of five entrusted with the preparation of a program. After adoption by the committee and acceptance with minor adjustments, on the part of the faculty, it was elaborated by the architects.

The plan grew out of the unique library tradition of the University. Heretofore the library had not had a stack, but consisted of a group of departmental collections, each shelved in a separate room or suite of rooms. The problem was to preserve to faculty and students that immediate contact with all the material of a subject, so important to work of research, and yet secure the convenience of the inevitable stack. This was essentially accomplished by putting the offices and seminar rooms of a department on one side of a corridor, and on the other the stack with accommodations therein for graduate students. The building floors correspond to alternate deck floors of the stack and in two tiers, contained between one floor and the next, are stored books of the subject pursued by the department across the corridor at that level. In the stack a space fifteen feet wide is left between ends of ranges and the prismatic glass windows. Terrazzo floors, surfaced with cork or linoleum, are laid at building floor levels, and here are tables, chairs and individual lights for graduate students. To complete the departmental organization of the stack, deck-slits at building-floor levels are closed and forced ventilation is provided.

Nor is this all. Kindred departments can be brought to the same floor for there are two such stack systems, set sixty feet apart. The room which ties them together on each floor is the seat of library service and control, with departmental librarian, branch catalog, current journals, new, reserved and reference books, etc.

The stacks will ultimately contain nine tiers, each consisting of thirteen ranges, 21 feet long. At present, however, only tiers 3 to 8 inclusive are equipped. These have nearly ten miles of shelving, accommodating about 450,000 volumes. Approximately 300 graduate students can find accommodations in the stacks and their adjacent reference rooms. The rooms across the front and rear provide quarters for undergraduate instruction but are intended for future expansion of graduate work and library administration.

The reading room occupies a complete floor in the rear, being reached from both lateral corridors as well as through an ornate enclosed bridge spanning the court. It has over 6,000 square feet of floor space, and an abundance of natural light coming from four sides and the top. Artificial illumination is operated under the indirect system. The floor is covered with inlaid cork. The radiators are recessed and send their heat through horizontal grilles in the window sills. Around the walls is an unbroken line of shelving which will hold about 15,000 volumes and 300 current journals. The room opens into both stacks at the fifth tier, *i.e.*, midway vertically.

As for control, one desk attendant in the reading room at night can throw open all shelves and still have command. In the day, three suffice.

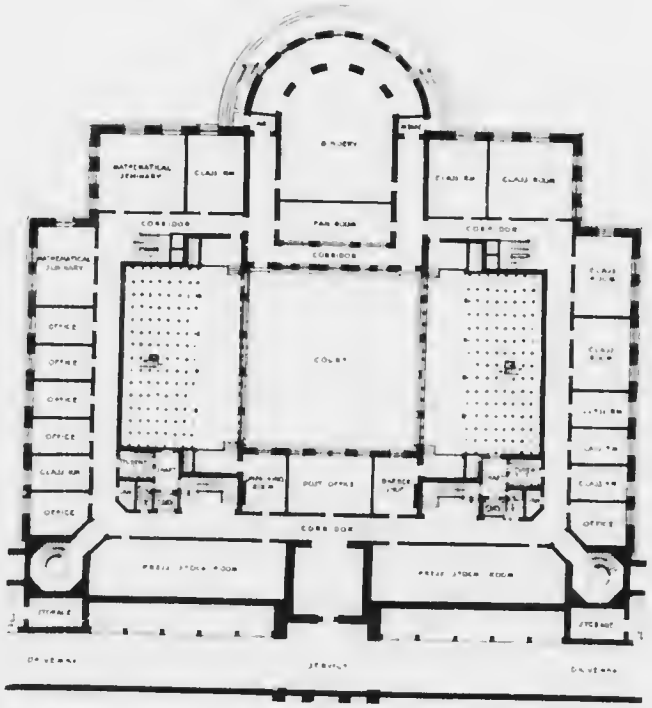


Fig. 165 BASEMENT FLOOR PLAN

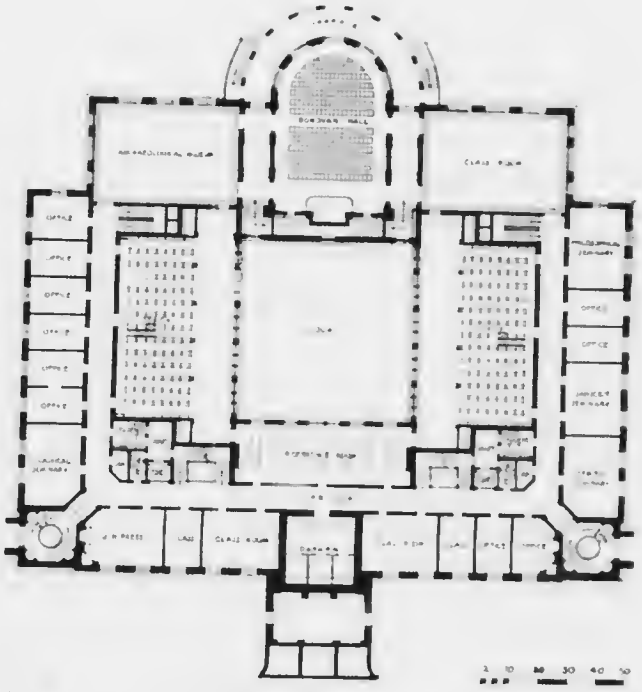


Fig. 166 GROUND FLOOR PLAN

GILMAN HALL, JOHNS HOPKINS UNIVERSITY, BALTIMORE, MD

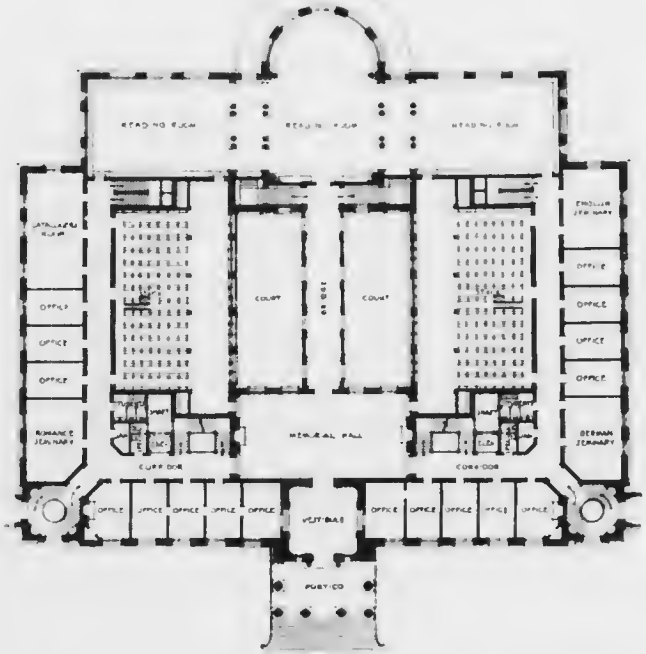


Fig. 107 FIRST FLOOR PLAN

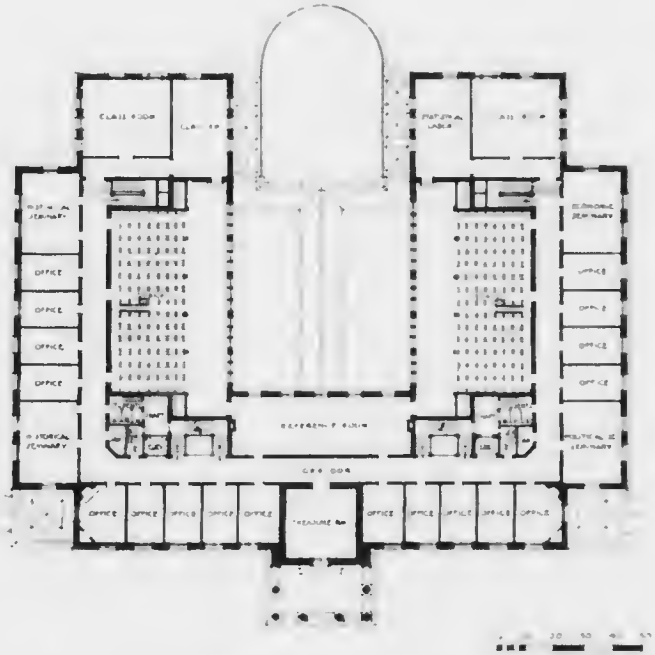


Fig. 108 SECOND FLOOR PLAN

GILMAN HALL, JOHNS HOPKINS UNIVERSITY, BALTIMORE, MD

Fig. 169 HARPER MEMORIAL LIBRARY, UNIVERSITY OF CHICAGO

SHEPLEY, RUTAN & COOLIDGE, Architects DR. ERNEST D. BURTON, Director

THE HARPER MEMORIAL LIBRARY, UNIVERSITY OF CHICAGO

SHEPLEY, RUTAN & COOLIDGE, Architects

DR. ERNEST D. BURTON, Director

FROM 1892 to 1902 the General Library of the University of Chicago was housed in a temporary one-story brick building. In 1902 the library moved into the new Press Building, and in the same year the first active steps were taken toward the erection of a permanent central library building. The committee appointed for the purpose recommended that the library building be made the central member of a group of nine buildings which should include the Divinity School, Law School, Historical and Social Science group, Philosophy group, Classical group, Modern Language group and the Oriental group, each to contain a departmental library, so constructed as to have the reading rooms of each at approximately the same level with the reading room of the central building.

Mr. John D. Rockefeller promised to give, up to $800,000, three-fourths of whatever amount should be raised for the erection of a central library building as a memorial to Dr. Wm. Rainey Harper, first President of the University. Over $200,000 was raised in subscriptions. The above sums with interest which accrued before and during the process of building, somewhat exceeded one million dollars. Of this sum approximately $800,000 was spent upon the building and its furniture, and over $200,000 set aside as an endowment fund for the physical maintenance of the building. Ground was broken on January 10, 1910, the corner-stone laid June 14, 1910, and the building completed in June, 1912.

The main reading room is on the third floor of the middle section of the Harper Library. Adjoining it in the west tower is the public catalog and general delivery room. From this floor bridges lead immediately to the libraries in the Haskell Oriental Museum and the Law Building. Eventually there will also be immediate communication with the reading rooms of the other buildings of the group, which still remain to be built. The general administrative offices and working rooms of the libraries are on the second floor. Other offices and rooms for special collections are provided in the fourth, fifth and sixth stories of the two towers.

The bookstacks rest directly on the basement floor and are carried independently of the building. The first floor, with the exception of the east tower stack, is temporarily given up to classrooms and a suite of offices for the president of the university.

Eventually the partitions of this space and those of the floor above will be removed and the stack extended from below, increasing the present capacity of about 525,200 volumes to over 1,000,000 volumes. The basement stack is so designed that when the additional stack tiers are added in the first and second stories the weight will be carried through the basement stack to the basement floor and not on the main first floor

In the building there are 81 rooms providing accommodations for over six hundred readers and office space for about 50 members of the staff and faculties. A passenger elevator and two stairways extend the entire height of each tower. Electric book-lifts in both towers run from lower basement to the sixth floor. Pneumatic tubes for the conveyance of book orders and charging cards connect various parts of the building. Speaking tubes and telephones facilitate communication.

The center court, bounded on the south by the library building; on the east by the Law School, and on the west by the Haskell Oriental Museum, will be known as the Harper Court, and eventually, it is expected, there will stand in the center of it a bronze statue of President Harper.

In the stone carvings, both exterior and interior, in addition to the traditional designs characteristic of Gothic architecture, much use has been made of the coats of arms of European, American and Asiatic universities, and of the individual marks of the most famous European printers.

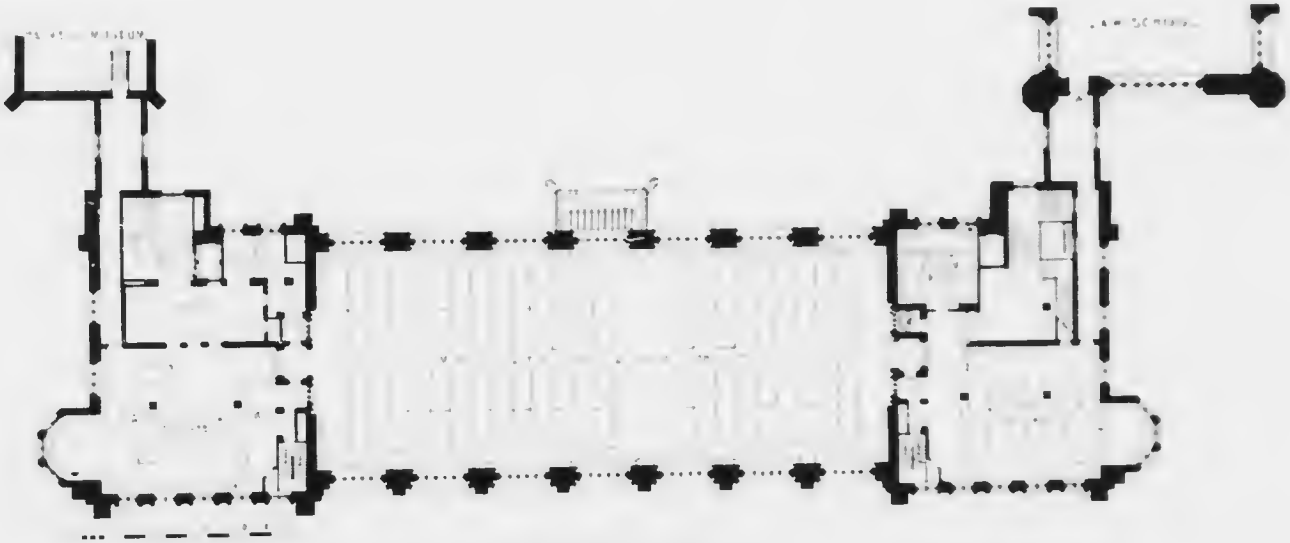


Fig. 170

THIRD FLOOR PLAN

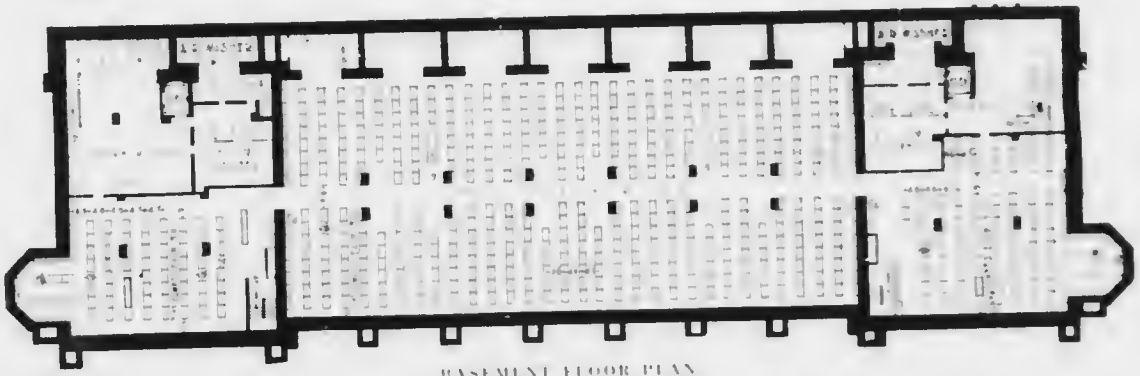


Fig. 171

BASEMENT FLOOR PLAN

HARPER MEMORIAL LIBRARY, UNIVERSITY OF CHICAGO

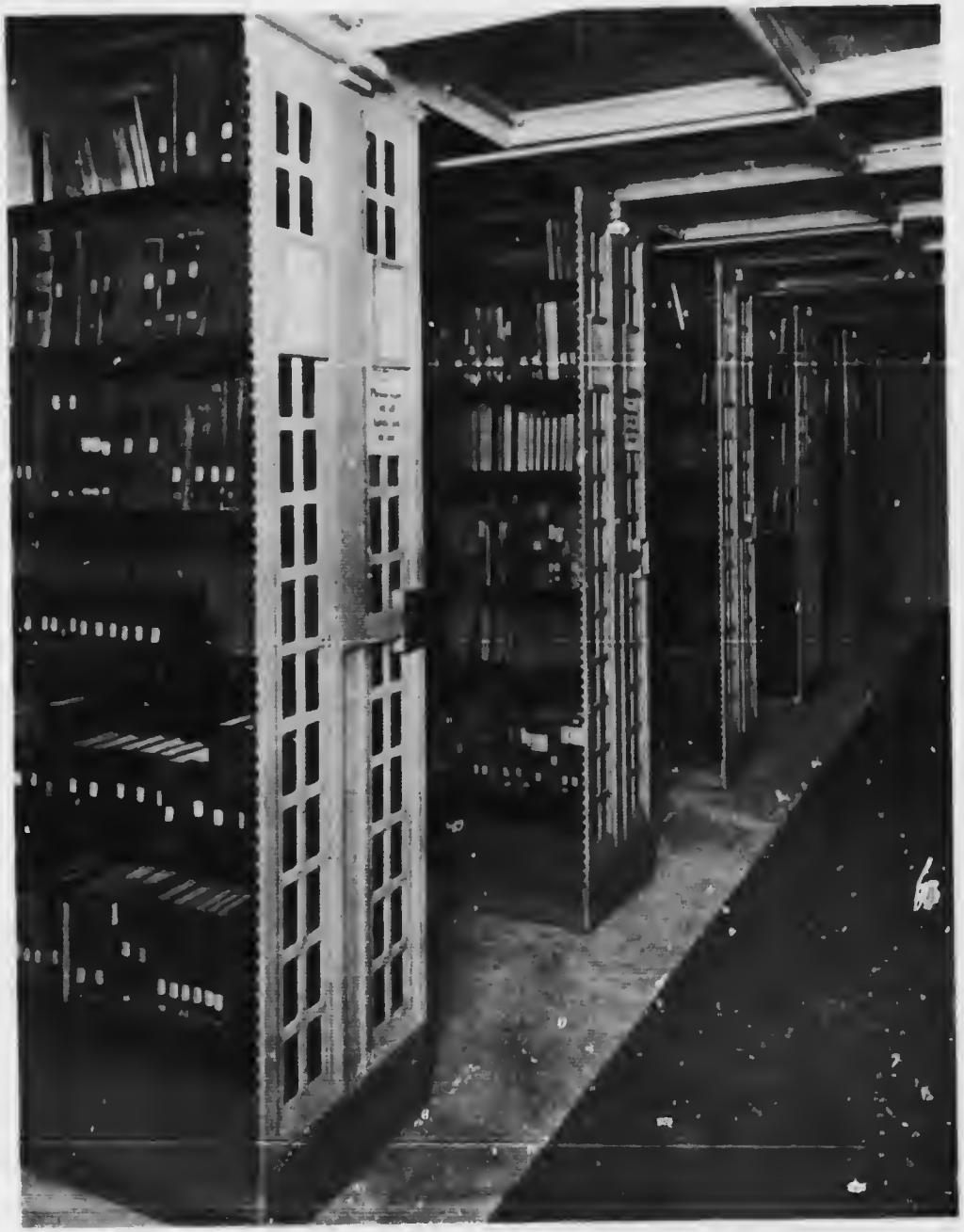


Fig. 172. HARPER MEMORIAL LIBRARY, UNIVERSITY OF CHICAGO

Basement tier of Snead Standard Stack showing side switches on end shelf supports.

UNION THEOLOGICAL SEMINARY, NEW YORK CITY

Fig. 173
ALLEN & COLLENS, Architects

DR. HENRY PRESERVED SMITH, Librarian

This group covers a city block and consists of a series of connected buildings almost enclosing an interior court. The group includes a chapel, library, residences for president and professors, dormitories, class rooms and administration offices. The above view, taken in the court, shows the library at the extreme right, with the tall narrow windows of the stack room below and the tracery windows of the reference hall above.

This group covers a city block and includes the president and professors, dormitories, class rooms and administration offices. The above view, taken in the court, shows the library at the [illegible] windows of the stack room below and the tracery windows of the reference hall above.

Fig. 174. VIEW OF CAMPUS FRONT OF KENT HALL, THE COLUMBIA UNIVERSITY LAW SCHOOL, NEW YORK CITY

McKim, Mead & White, Architects — F. A. Goetze, Consulting Engineer — Frederick C. Hicks, Acting Librarian

The two-story basement contains a four-tier Snead Standard Stack, students' rooms and work rooms. The main floor is entirely devoted to the library reading room and the upper floors to class rooms, professors' offices, etc

Fig. 175. REAR VIEW, SHOWING BOOKSTACK WING AT RIGHT

Fig. 176 COMMONS HALL

Fig. 177 VIEW IN STACK ROOM

ANDOVER-HARVARD THEOLOGICAL SEMINARY, CAMBRIDGE, MASS.

ALLEN & COLLENS, Architects

DR. OWEN W. GATES, Librarian

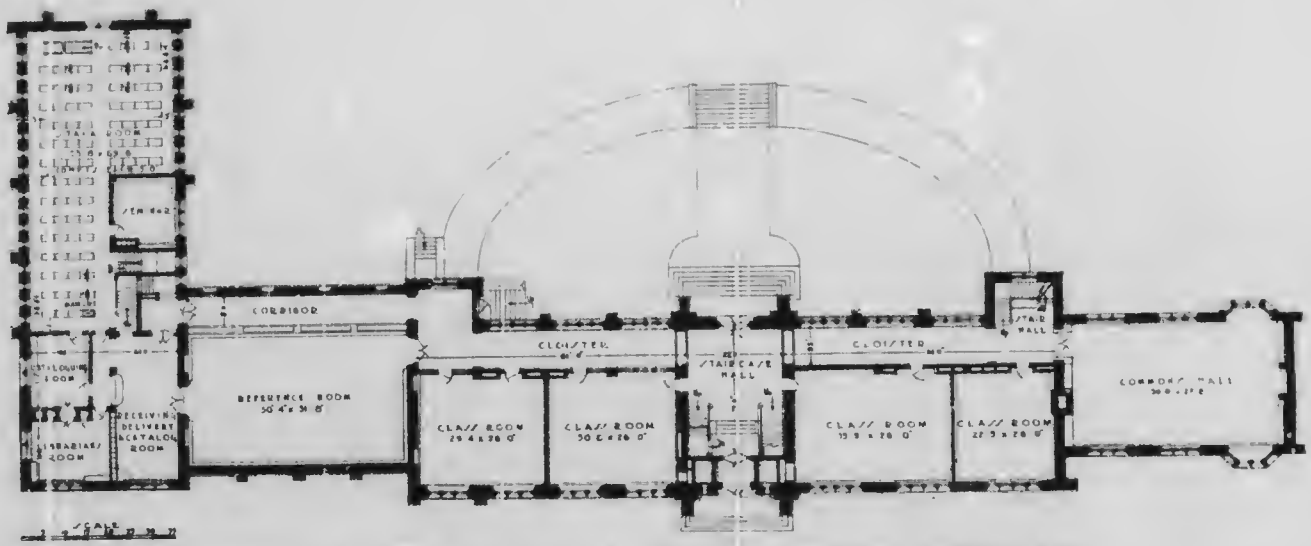


Fig. 178. FIRST FLOOR PLAN, ANDOVER-HARVARD THEOLOGICAL SEMINARY, CAMBRIDGE, MASS.

This is financially an independent institution but is practically one of the departments of Harvard University. The present building forms the first section of what is eventually to be a large group. It includes class rooms, students' rooms, administrative offices and a library. The five-tier Snead Standard Stack is Gothic in detail to harmonize with the design of the building and furnishings.

Fig. 179 VIEW FROM THE CAMPUS

OHIO STATE
UNIVERSITY LIBRARY
COLUMBUS, O.

ALLEN & COLLINS, Architects
MISS OLIVE JONES, Librarian

FIG. 180 VIEW IN SEVEN TIER SNEAD STANDARD STACK

Several shelf compartments have been temporarily omitted to make room for study tables near windows. Along the center 3 foot aisle, partition shelf supports have been used instead of range fronts so that adjustable shelves can later be placed across the aisle to increase the stack capacity. In the basement tier, structural steel columns have been installed to support the six tier stack above. See Fig. 118, page 82. The columns are designed so that, at some future time, shelf supports and shelves can be easily attached. Space is left above the stack to allow the installation of a future eighth tier.

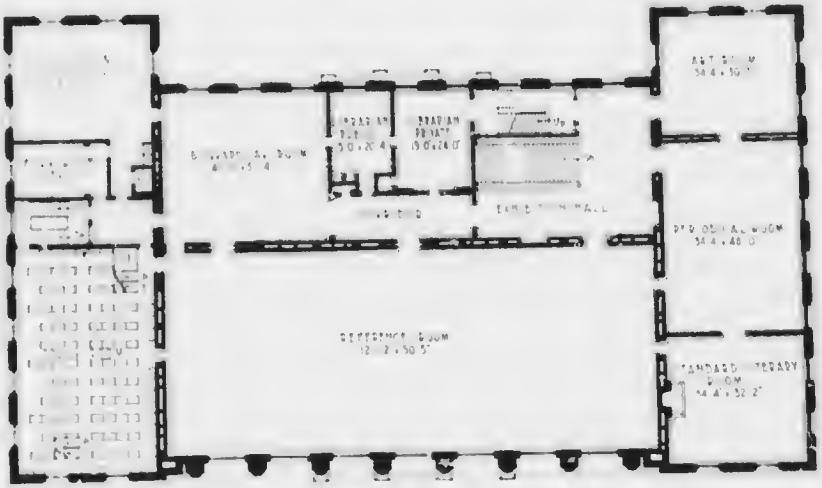


Fig. 181 SECOND FLOOR PLAN

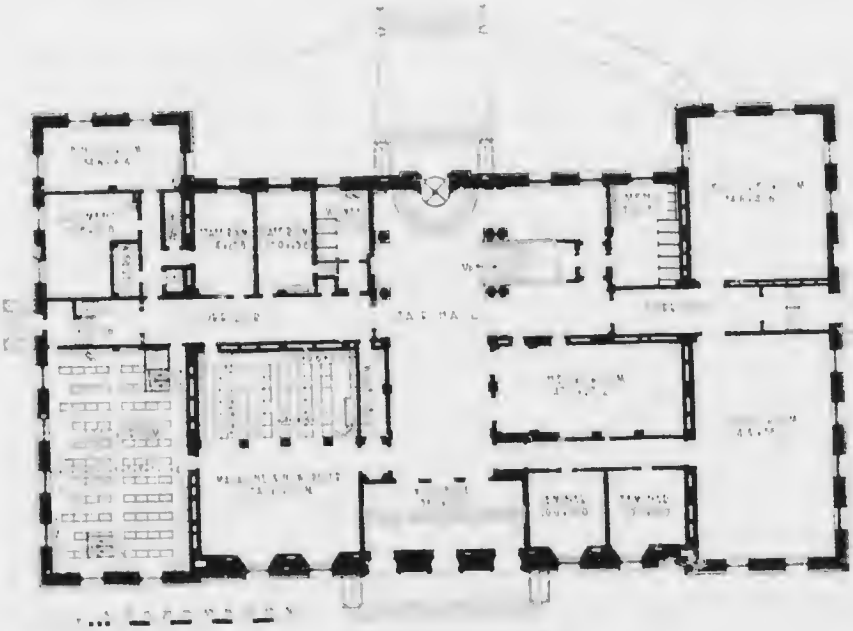


Fig. 182 FIRST FLOOR PLAN

OHIO STATE UNIVERSITY LIBRARY, COLUMBUS, O

The small stack adjoining the main stack room was designed for the storage of bound newspapers and periodicals. Story heights of the building are in even multiples of the stack tier heights so that the main floors line up with certain of the stack deck floors.

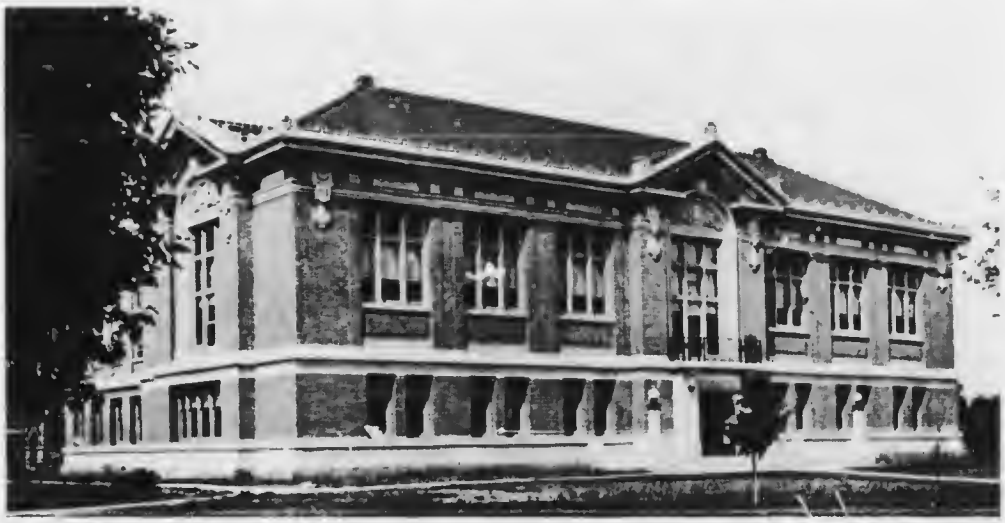


Fig. 183. VIEW OF EXTERIOR

Fig. 184 MAIN READING ROOM

PURDUE UNIVERSITY LIBRARY, LAFAYETTE, IND

PATTON & MILLER, Architects WILLIAM H. HEPBURN, Librarian

"Direct-indirect" system of illumination used throughout the building.

Fig. 185. MAIN FLOOR PLAN

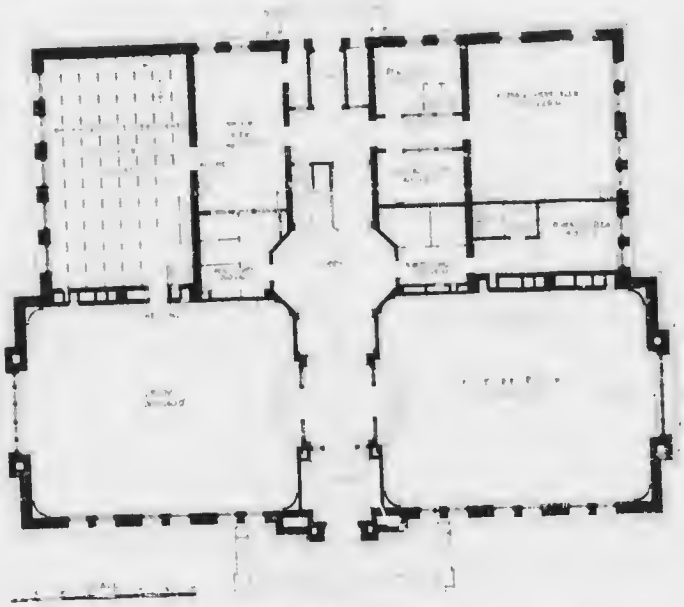


Fig. 186. GROUND FLOOR PLAN

PURDUE UNIVERSITY LIBRARY, LAFAYETTE, IND.

Stack room contains a three-tier Snead Standard Stack, third tier on a level with main floor of building. Provision has been made for two additional tiers above present stack

Fig. 187 THEOLOGICAL SEMINARY OF ST. CHARLES BORROMEO, OVERBROOK, PA

HARRIS & RICHARDS, Architects

FATHER AUGUSTINE J. SCHUETH, Librarian

The new library and gymnasium wing is shown to the left in the above illustration, the library occupying the upper floor

Fig. 188 INTERIOR OF LIBRARY

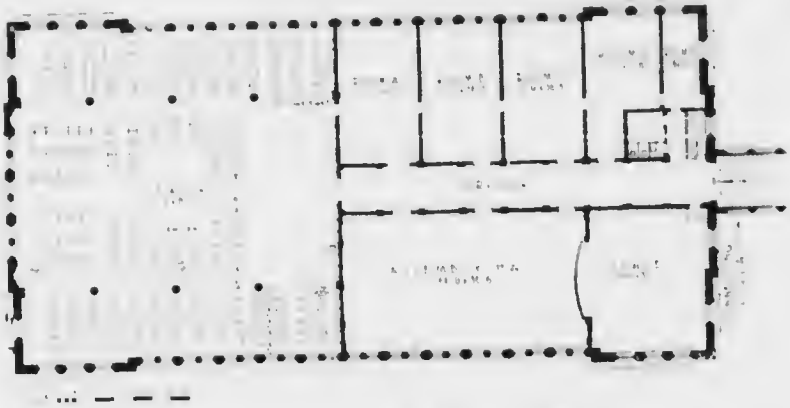


Fig. 189 MAIN FLOOR PLAN OF LIBRARY WING

THEOLOGICAL SEMINARY OF ST. CHARLES BORROMEO, OVERBROOK, PA.

The library contains a one tier Snead Standard Stack which has a capacity of 103,300 volumes. Solid paneled design range fronts have been supplied and the bottom fixed shelf in each range has been extended to accommodate oversize books. Provision has been made for the addition of a future tier above and the stack is fitted with a removable cornice which may be reset on the future second tier. The electric conduits are carried directly on the stack cover plates. See Fig. 127. When the stack is extended, the conduits will be disconnected at the walls and raised to a new level above the second tier, no alterations being necessary.

Fig. 196 QUADRANGLE FRONT

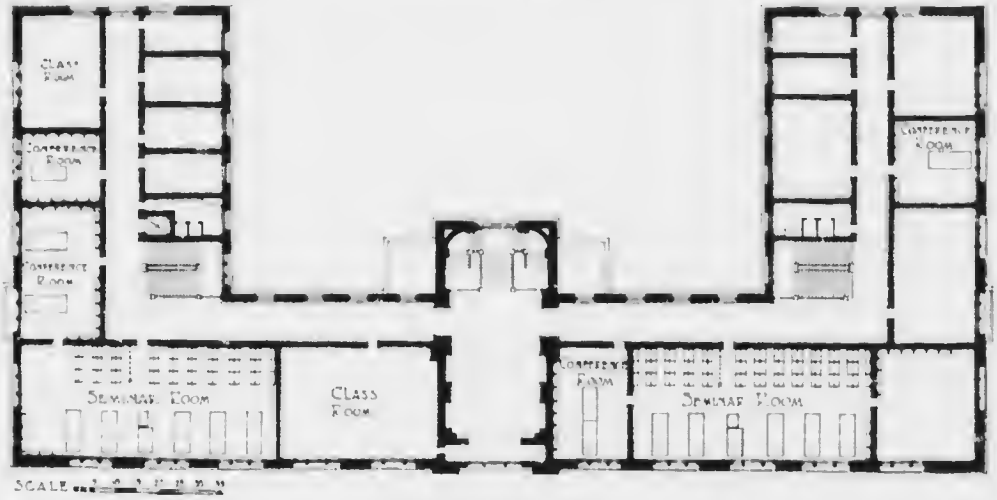


Fig. 197 SECOND FLOOR PLAN

LINCOLN HALL, UNIVERSITY OF ILLINOIS, URBANA, ILL.

JAMES M. WHITE, Supervising Architect PHINEAS L. WINDSOR, Librarian

Snead Standard Stacks in seminar and special study rooms. Those in the seminar rooms are designed to receive future second tiers. The building, known as "a laboratory of the intellectual sciences," has its library divided and placed in separate rooms or series of rooms so that each becomes a working laboratory for a special department, containing books, documents, maps, photographs, slides, lists and other material relative to the subjects treated.

Fig. 192 EXTERIOR VIEW

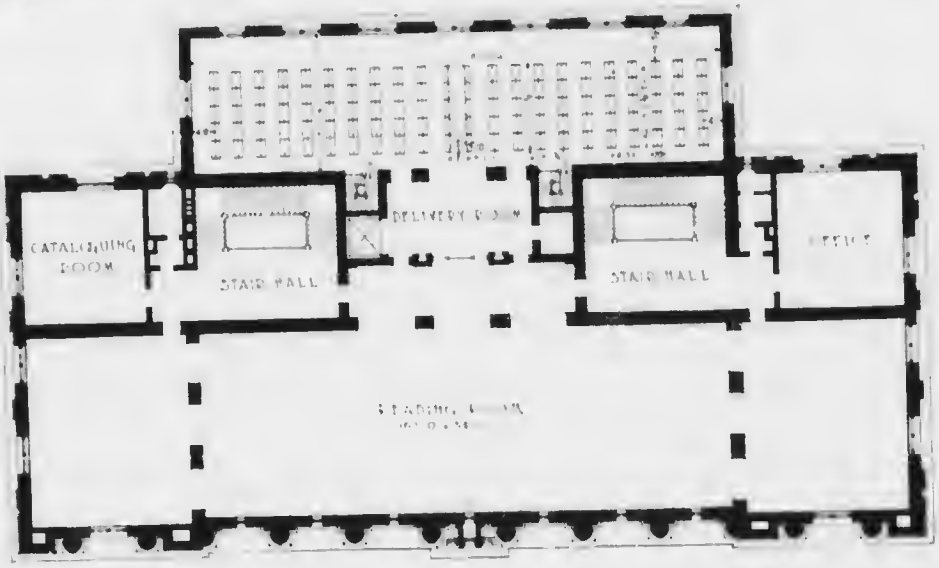


Fig. 193 FIRST FLOOR PLAN

IOWA STATE TEACHERS' COLLEGE, CEDAR FALLS, IOWA

Miss Ellen D. Briscoe, Librarian

Proudfoot, Bird & Rawson, Architects

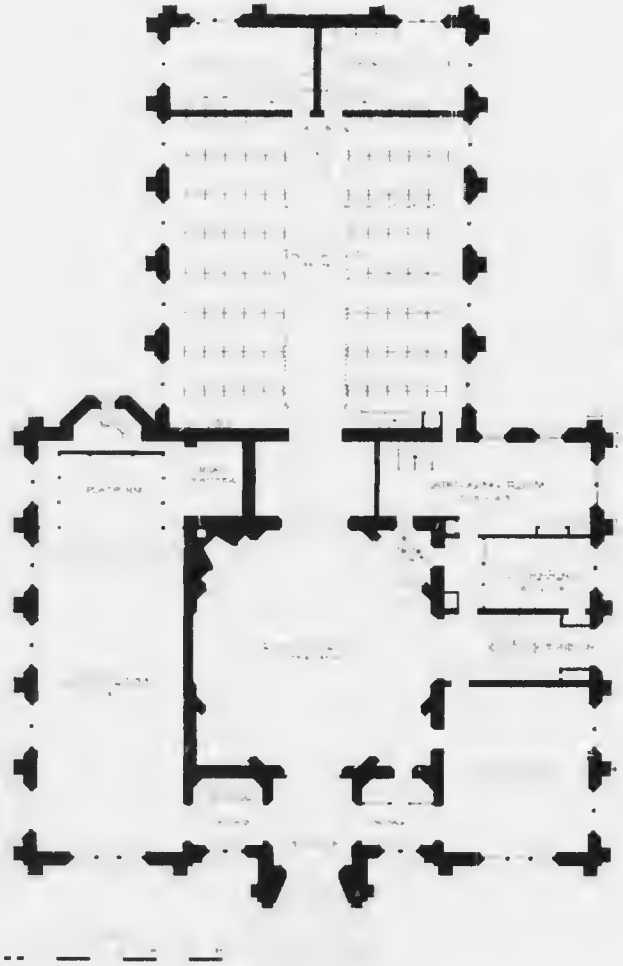


Fig. 194 FIRST FLOOR PLAN

Fig. 195 EXTERIOR VIEW

KRAUTH MEMORIAL LIBRARY

LUTHERAN THEOLOGICAL SEMINARY

MT. AIRY, PA.

Watson & Huckel
Architects

Rev. Luther D. Reed
Librarian

The stack is entirely fireproof and separated from the rest of the building by a solid masonry wall and fireproof doors. The auditorium in the left wing runs through two stories, but the right hand wing contains a large seminar room and three research rooms on the second floor. In the basement are the packing rooms, bindery, dining hall, kitchen and toilets.

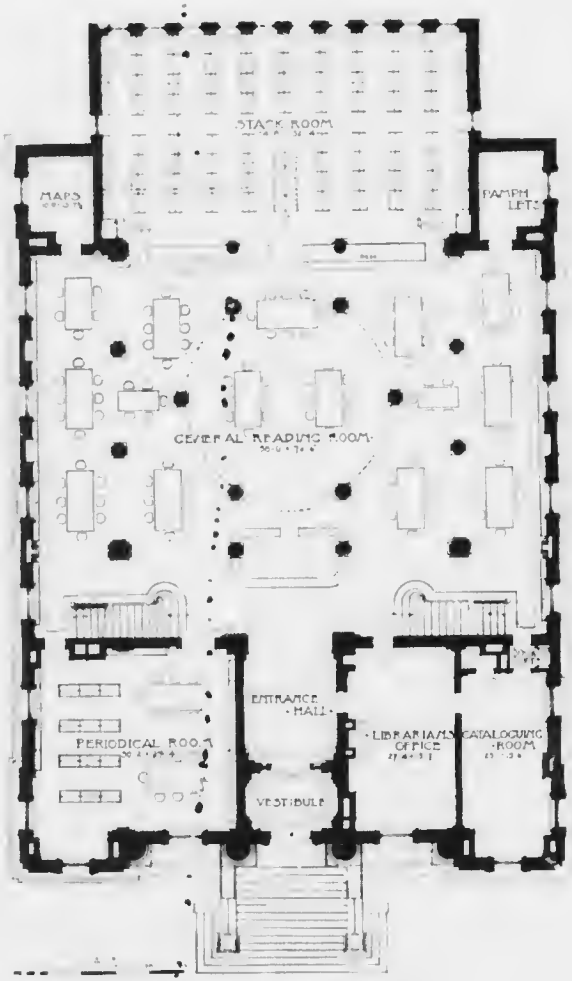


Fig. 196 FIRST FLOOR PLAN

Fig. 197 EXTERIOR VIEW

INDIANA STATE NORMAL SCHOOL LIBRARY
TERRE HAUTE, IND

J. F. Alexander & Sons, Architects — Arthur Cunningham, Librarian

Building contains a four tier Snead Standard Stack, the second and third tiers of which were transferred from an old structure to this new building. Provision has been made for the addition of two tiers of stack over those installed at present.

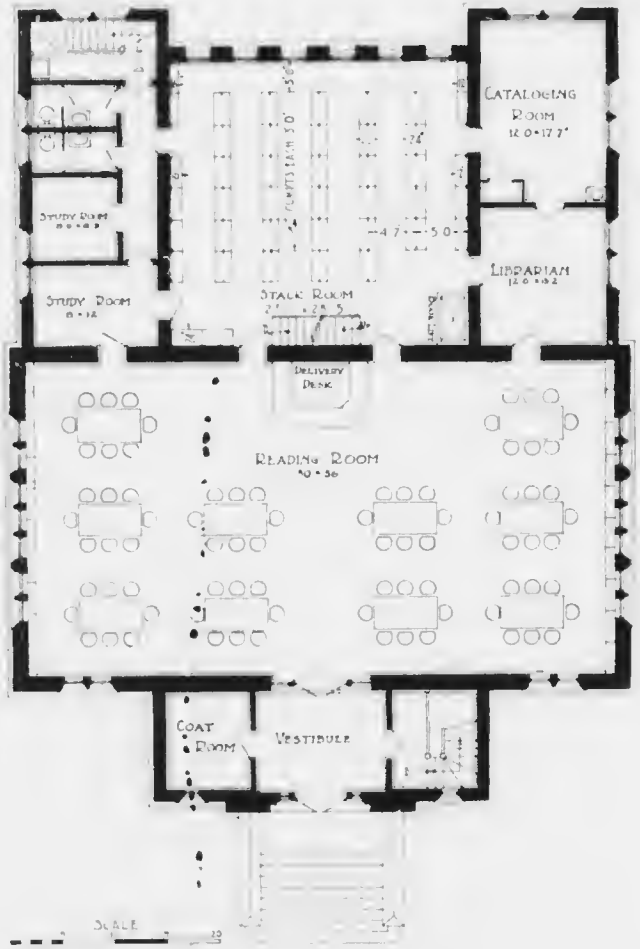


Fig. 19 FIRST FLOOR PLAN

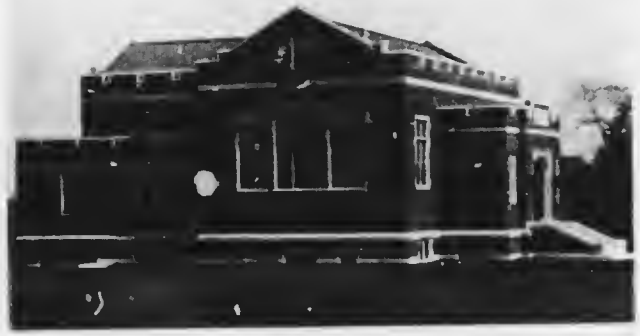


Fig. 19a VIEW OF EXTERIOR

HEBREW UNION COLLEGE LIBRARY

CINCINNATI, O.

A. Lincoln Fechheimer
Architect

Adolph S. Oko
Librarian

The library is one of two structures which represent the beginning of a large college group. These buildings are located on a site neighboring the University of Cincinnati, so that co-operative work between the two institutions is possible. To the rear of the library the ground falls away allowing a full height, well lighted basement story.

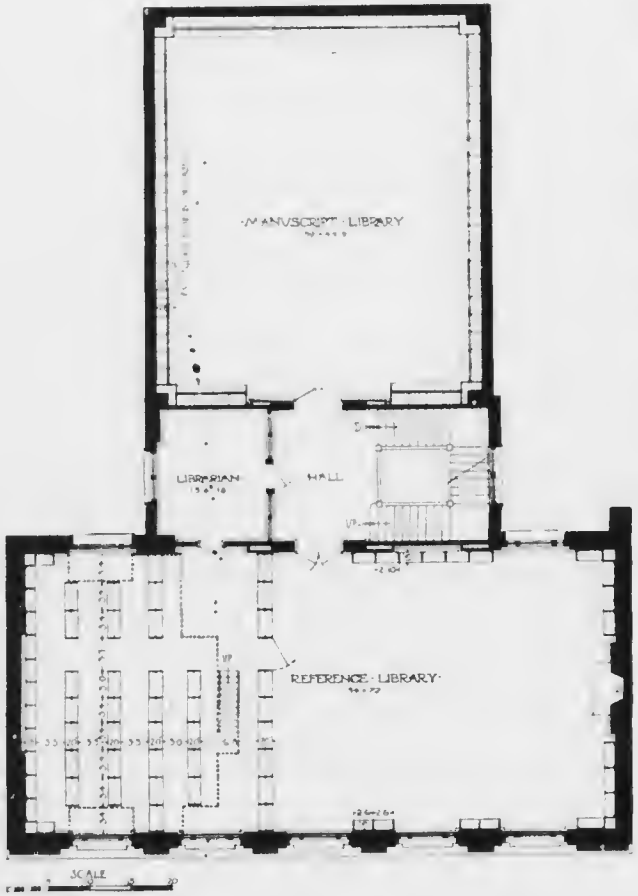


Fig. 200. THIRD FLOOR PLAN

Fig. 201 FRONT ELEVATION

JEWISH THEOLOGICAL SEMINARY

NEW YORK CITY

ARNOLD W. BRUNNER
Architect

PROFESSOR ALEX. MARX
Librarian

In the reference library the books are stored in open shelves, but in the manuscript library, the rare and valuable possessions are placed under lock and key in specially constructed Snead Standard Stack, with glass doors. This stack has 24" shelves in the lower compartments and 15" shelves above, with a reading ledge between. It contains more than 12,000 volumes, constituting the largest collection of rare Hebraica in the United States and the fourth largest in the world.

Fig. 202 VIEW FROM THE CAMPUS

Fig. 203 VIEW IN FIRST TIER OF STACK ROOM

FRANCES FOLSOM CLEVELAND LIBRARY, WELLS COLLEGE, AURORA, N. Y.

BEVERLY S. KING AND HARRY LESLIE WALKER
Associated Architects

MISS ALICE E. SANBORN
Librarian

Funds for the purchase of this stack were raised by individual and group donations. The opposite ends of the ranges illustrated above contain tablets marking the separate sections purchased by the respective donors.

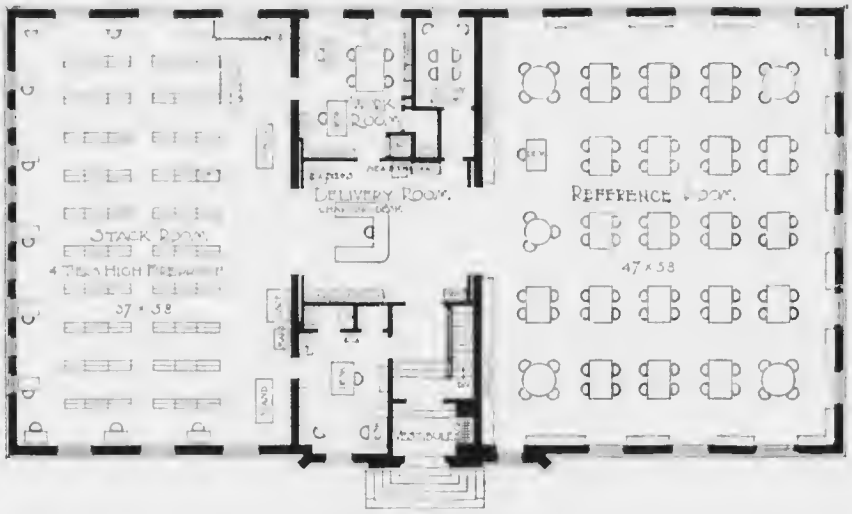


Fig. 201 FIRST FLOOR PLAN

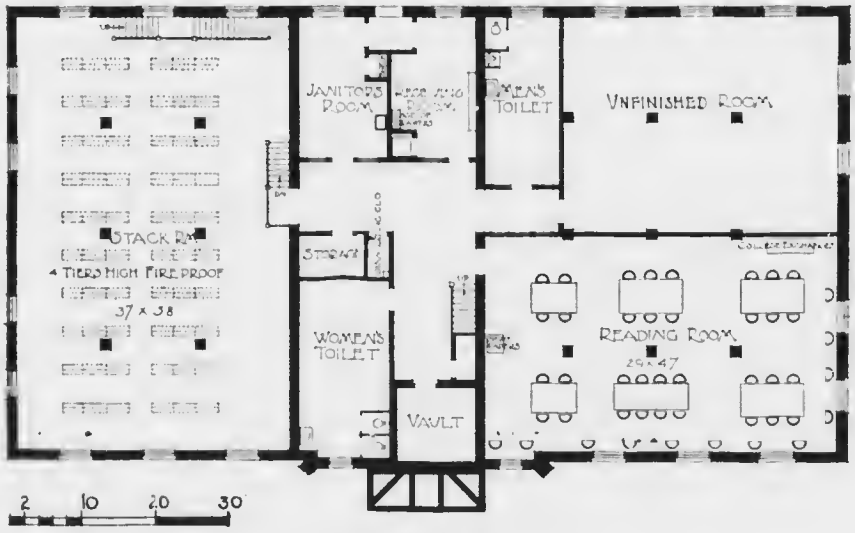


Fig. 202 BASEMENT FLOOR PLAN

FRANCES FOLSOM CLEVELAND LIBRARY, WELLS COLLEGE, AURORA, N. Y.

Fig. 206. ST. ELIZABETH'S COLLEGE LIBRARY, CONVENT STATION, N. J.

MACINNIS & WALSH, Architects — SISTER MARIE ELISE, Librarian

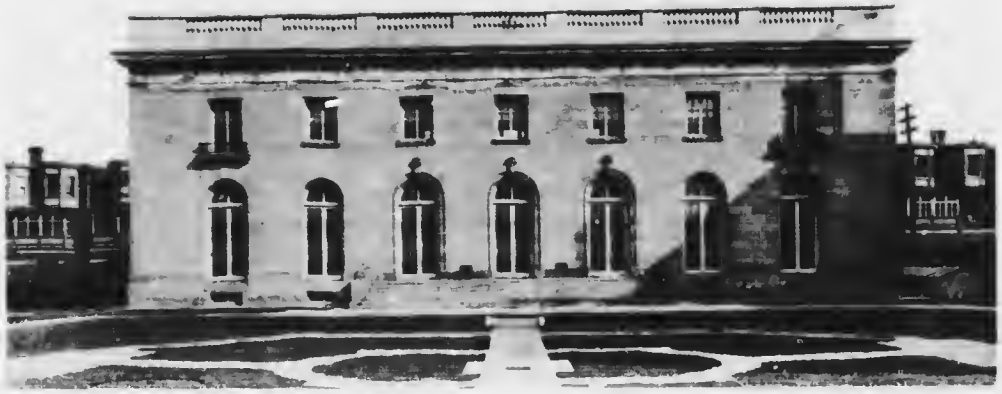


Fig. 207. DROPSIE COLLEGE LIBRARY, PHILADELPHIA, PA

PECHER & TACHAU, Architects — DR. CYRUS ADLER, Librarian

Building designed to house several departments at present, but provision has been made so that it may ultimately be used for library purposes only.

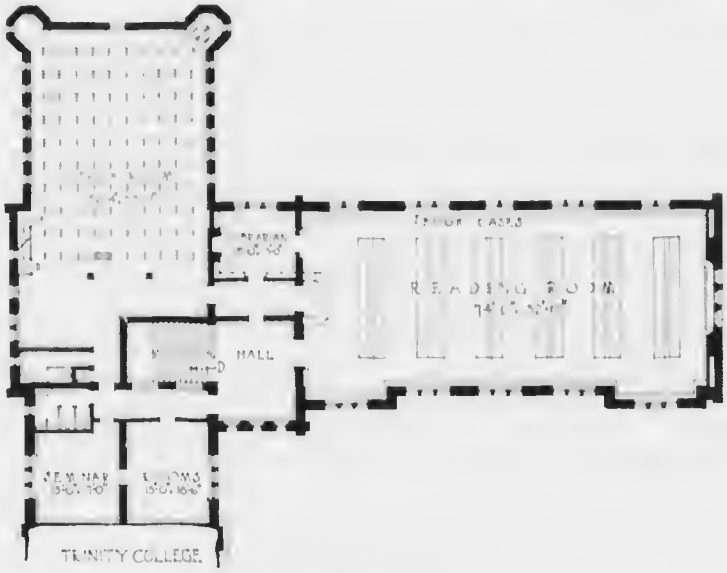


Fig. 298 SECOND FLOOR PLAN

Fig. 299 FIRST FLOOR PLAN

WILLIAMS MEMORIAL LIBRARY, TRINITY COLLEGE, HARTFORD, CONN.

LA FARGE & MORRIS, Architects WALTER B. BRIGGS, Librarian

Fig. 210 EXTERIOR VIEW

Fig. 211 FIRST FLOOR PLAN

DAVIS LIBRARY, PHILLIPS EXETER ACADEMY, EXETER, N. H.

CRAM, GOODHUE & FERGUSON, Architects — Miss MABEL CURTY, Librarian

On the ground floor are two rooms being used as study rooms. These will later be put to library use. A cataloging room, stack room and toilets are also contained on this floor.

Fig. 212 VIEW FROM CAMPUS

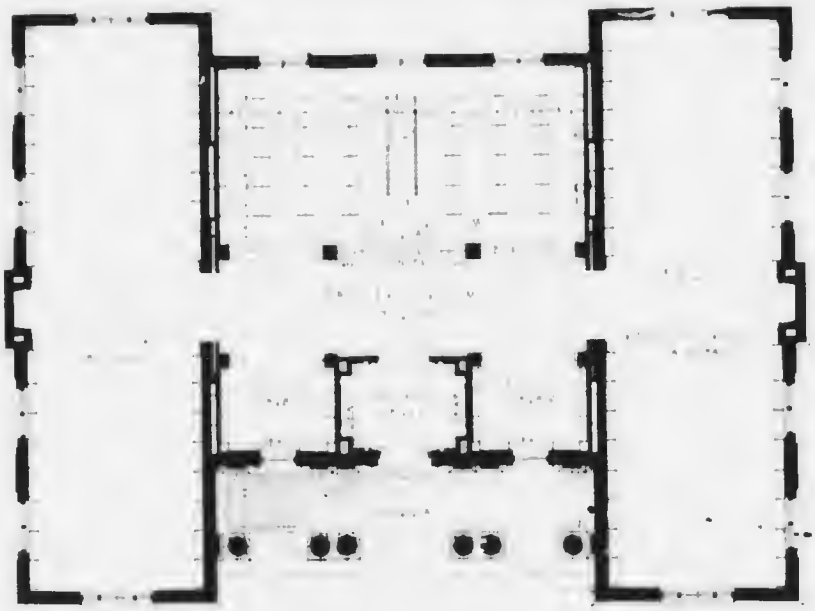
Fig. 213 GROUND FLOOR PLAN

VICTORIA COLLEGE LIBRARY, TORONTO, ONTARIO

SPROATT & ROLPH, Architects — A. E. LANG, Librarian

Upper story contains two large seminar rooms and several small rooms for research work. Basement contains offices, book bureau, receiving room, caretaker's quarters, attendant's room, cloak room, lavatories, boiler room and storage space. Stack room entirely fireproof; stone interior walls and steel sash.

EXTERIOR VIEW



FIRST FLOOR PLAN

SCHAUFFLER MEMORIAL LIBRARY, MOUNT HERMON, MASS.

PARISH & SCHOFIELD, Architects — Miss ELIZABETH CONWAY, Librarian

Fig. 36 EXTERIOR VIEW

Fig. 37 TWO TIER SNEAD STANDARD STACK, GOTHIC DETAIL

LOYOLA UNIVERSITY LIBRARY, NEW ORLEANS, LA

De Buys, Churchill & Labouisse, Architects Father Albert Biever, Librarian

Fig. 218

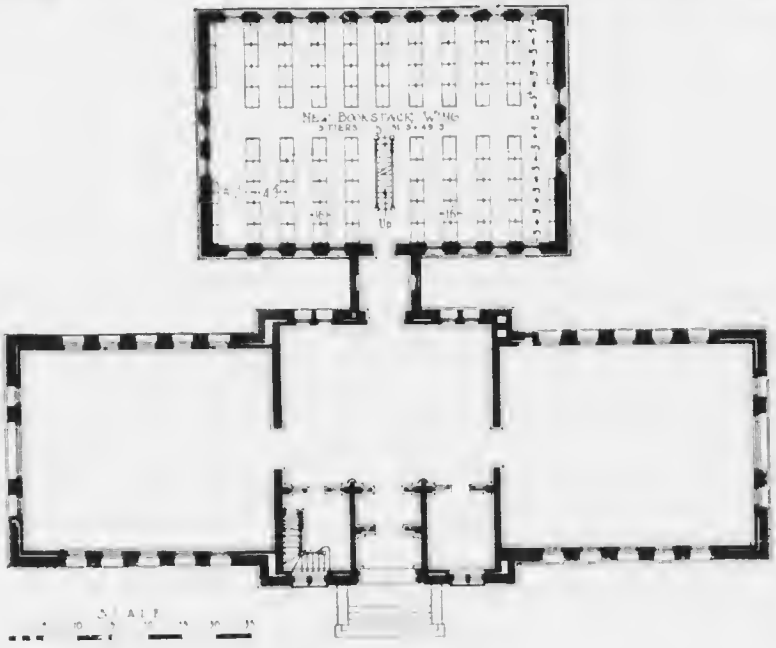


Fig. 219 FIRST FLOOR PLAN

VAN WICKLE MEMORIAL LIBRARY, LAFAYETTE COLLEGE, EASTON, PA.

HARRIS & RICHARDS, Architects — JOHN C. STONECIPHER, Librarian

When the new bookstack wing was added, the two-tier bracket stack contained in the old building, being too weak to support further construction, was reset as a single tier above a two-tier Snead standard Stack.

Fig. 220 FRONT ELEVATION

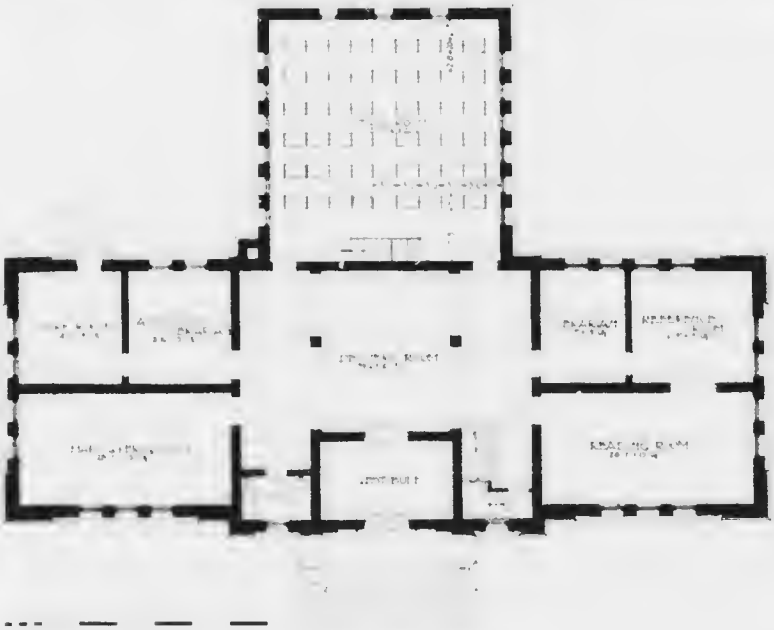


Fig. 221 FIRST FLOOR PLAN

COAST ARTILLERY TRAINING SCHOOL, FORT MONROE, VA

FRANCIS B. WHEATON, Architect MAJOR T. W. WINSTON, Librarian

Fig. 220 VIEW FROM CAMPUS

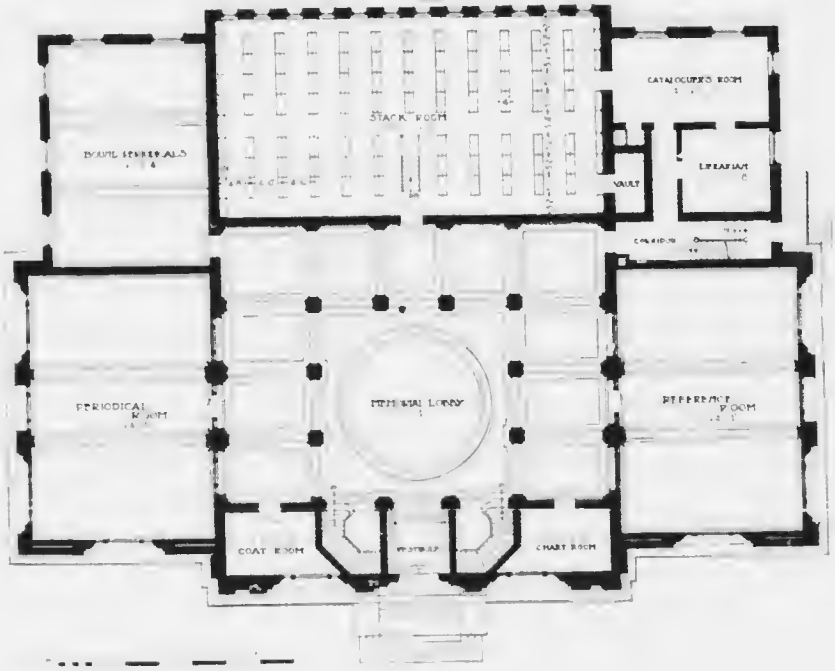


Fig. 221 FIRST FLOOR PLAN

UNIVERSITY OF NORTH CAROLINA LIBRARY, CHAPEL HILL, N. C.

FRANK P. MILBURN & Co. Architects — LOUIS R. WILSON, Librarian

Fig. 224 MAIN READING ROOM

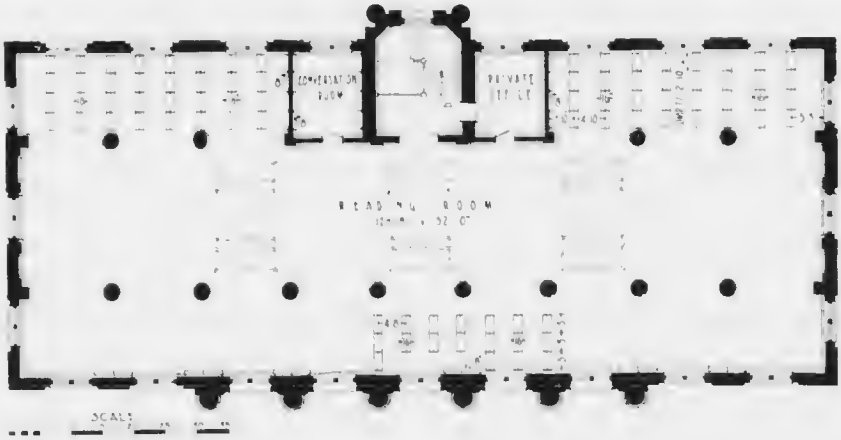


Fig. 225 THIRD FLOOR PLAN

IOWA STATE UNIVERSITY LAW LIBRARY, IOWA CITY, IA.

PROUDFOOT, BIRD & RAWSON, Architects MERTON L. PERSON, Librarian

Snead Standard Stack ranges with removable steel cornices form alcoves along the sides of the reading room giving students direct access to the books. The stack is designed to receive a mezzanine floor when an extension of capacity is required. When this addition is made, the cornices of the first tier ranges will be reset on those of the second tier.

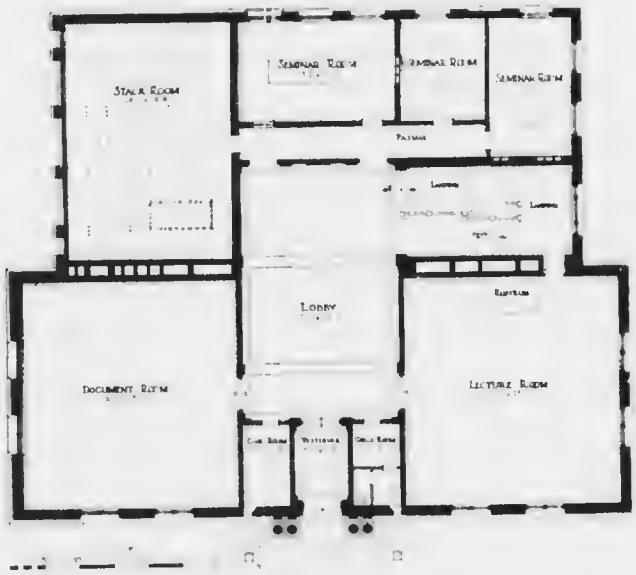


Fig. 226 FIRST FLOOR PLAN

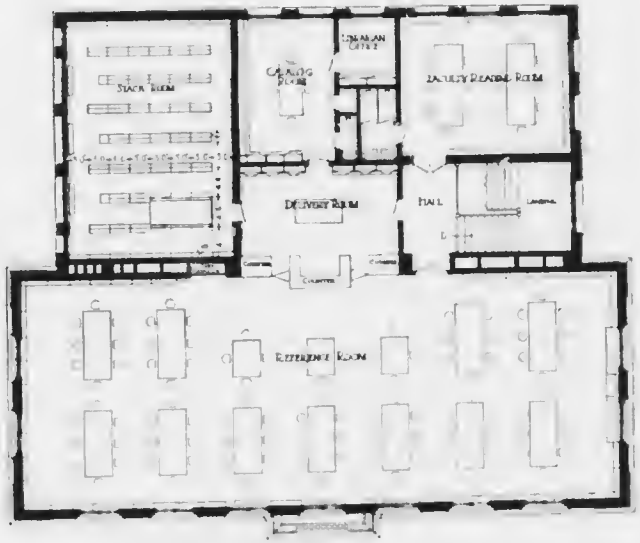


Fig. 227 SECOND FLOOR PLAN

UNIVERSITY OF TENNESSEE LIBRARY, KNOXVILLE, TENN

PATTON & MILLER, Architects

MISS SABRA W. VOUGHT, Librarian

Stack room contains one tier of Snead Standard Stack prepared to receive additional tiers above.

PUBLIC LIBRARIES

BIBLIOTHÈQUE ST SULPICE, MONTREAL
FALL RIVER, MASSACHUSETTS
SPRINGFIELD, MASSACHUSETTS
MULTNOMAH COUNTY, PORTLAND, OREGON
TORONTO, ONTARIO
DENVER, COLORADO
BROOKLINE, MASSACHUSETTS
BEVERLY, MASSACHUSETTS
GARY, INDIANA
LOUISVILLE, KENTUCKY
WASHINGTON, DISTRICT OF COLUMBIA
MANCHESTER, NEW HAMPSHIRE
NEW ROCHELLE, NEW YORK
ELIZABETH, NEW JERSEY
ST PAUL, MINNESOTA
EVANSTON, ILLINOIS
REGINA, SASKATCHEWAN
FERGUSON MEMORIAL, STAMFORD, CONN
SOMERVILLE, MASSACHUSETTS
MOOSE JAW, SASKATCHEWAN
LIBRARY OF HAWAII, HONOLULU
BANGOR, MAINE
MASON LIBRARY GREAT BARRINGTON, MASS.
OTTAWA, ONTARIO
WILLIAMSBURG BRANCH, BROOKLYN, N. Y
PACIFIC BRANCH, BROOKLYN, N. Y
CARROLL PARK BRANCH, BROOKLYN, N Y
LOUIS GEORGE BRANCH, KANSAS CITY, MO
SOUTHBORO, MASSACHUSETTS
PROCTOR, VERMONT
WHITINSVILLE, MASSACHUSETTS
NEWTOWN, PENNSYLVANIA
SYRACUSE, NEW YORK

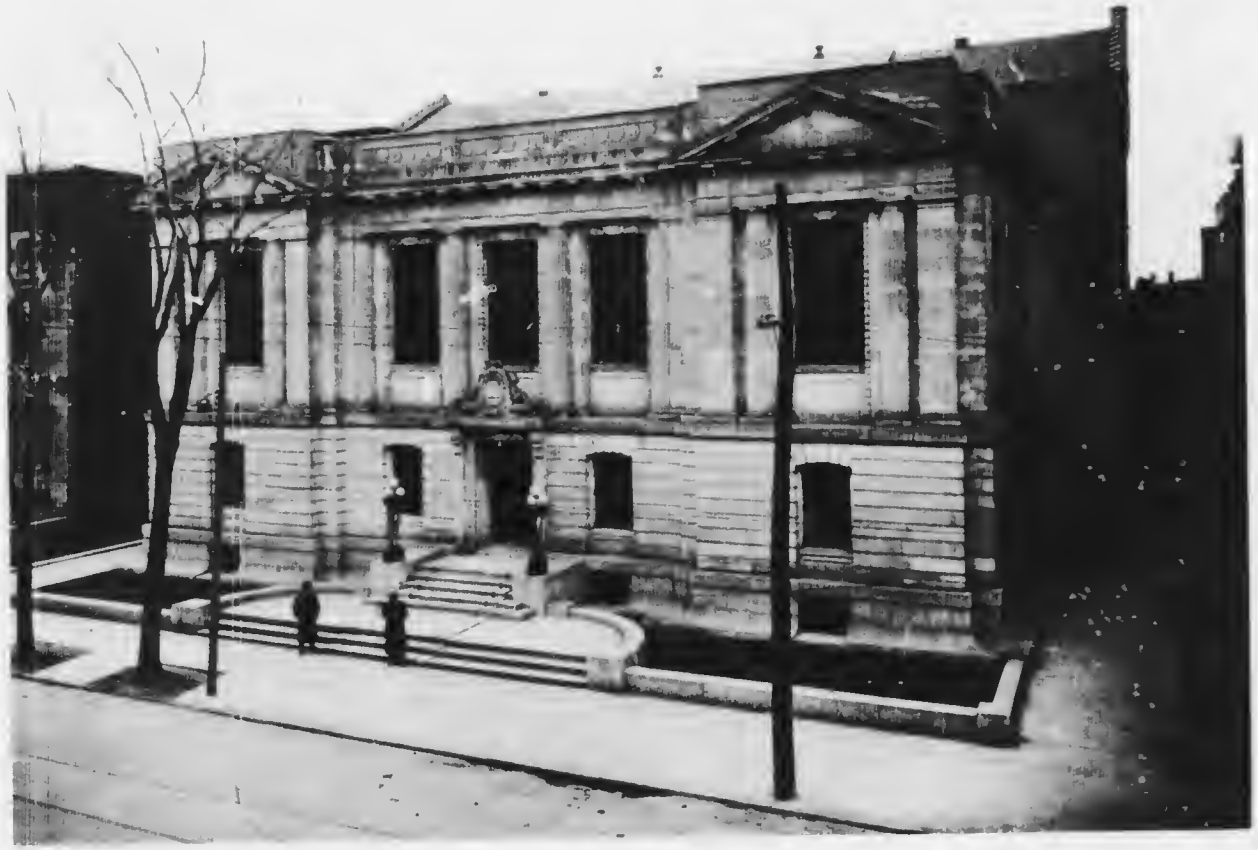


Fig. 228.

BIBLIOTHÈQUE ST SULPICE, MONTREAL, QUEBEC

EUGENE PAYETTE, Architect

ALCIDES FAUTEUX, Bibliothecaire

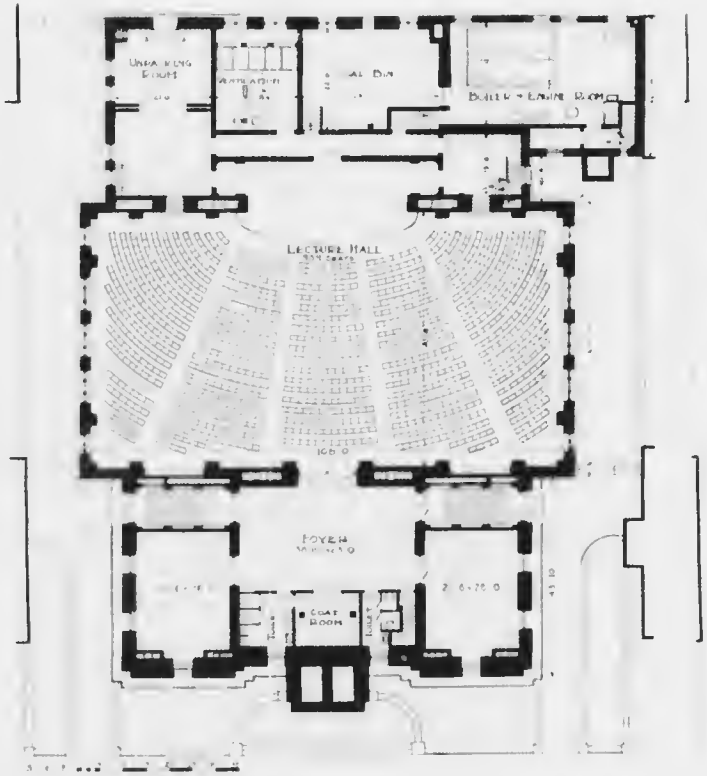


Fig. 229 BASEMENT FLOOR PLAN

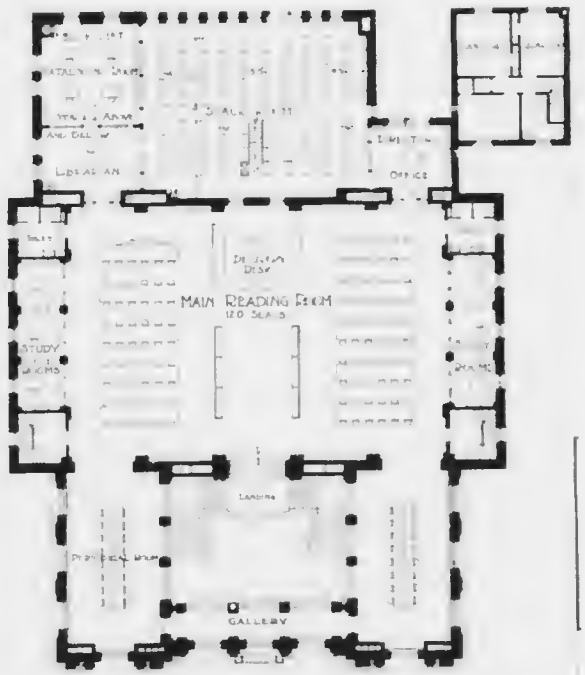
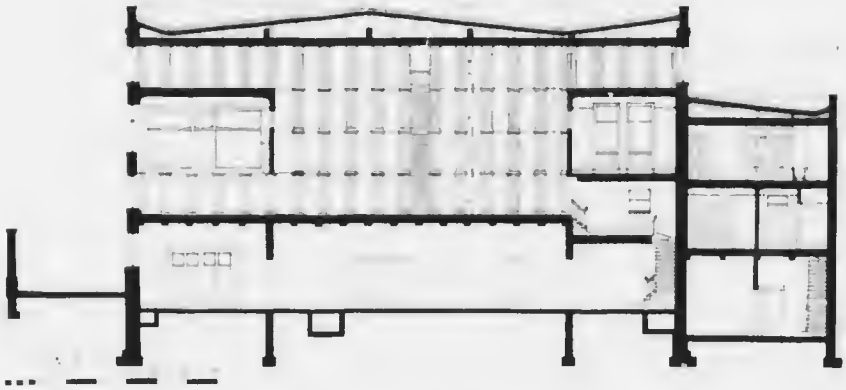


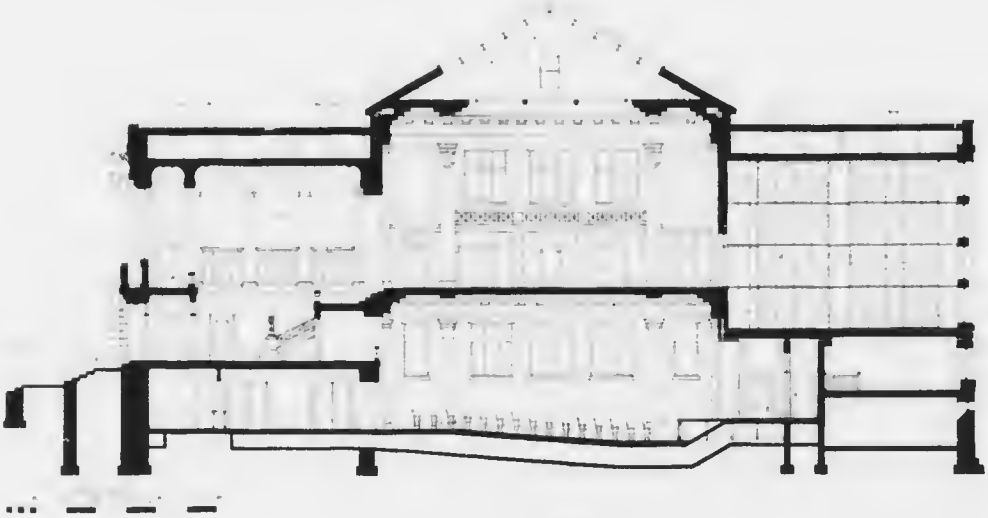
Fig. 230 MAIN FLOOR PLAN

BIBLIOTHÈQUE ST SULPICE, MONTREAL, QUEBEC

This building, erected for the people of Montreal by the Sulpician Order, contains three separate units. 1. A complete library building. 2. A lecture hall with auxiliary accommodations for both sexes, a stage with side rooms, and a foyer giving direct access to the street. 3. Janitor's quarters in direct connection with the library, lecture hall and street. Note in the transverse section on page 200, the way in which the cataloging, librarian's and director's rooms are built in the bookstack.



TRANSVERSE SECTION



LONGITUDINAL SECTION

BIBLIOTHÈQUE ST SULPICE, MONTREAL QUEBEC

Fig. 230 ENTRANCE VIEW

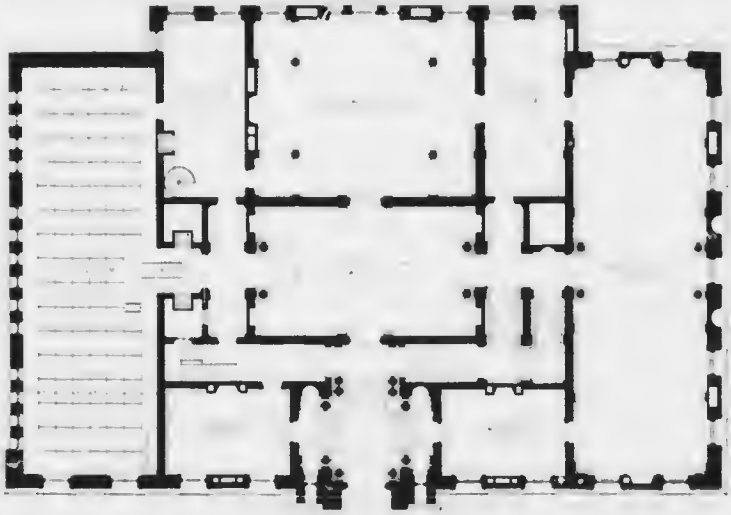


Fig. 231. MAIN FLOOR PLAN

FALL RIVER PUBLIC LIBRARY, FALL RIVER, MASS.

CRAM, GOODHUE & FERGUSON, Architects GEO. W. RANKIN, Librarian

The stack room, originally designed to accommodate six stack tiers, has been gradually filled up with Snead Standard Stack by adding one tier at a time.

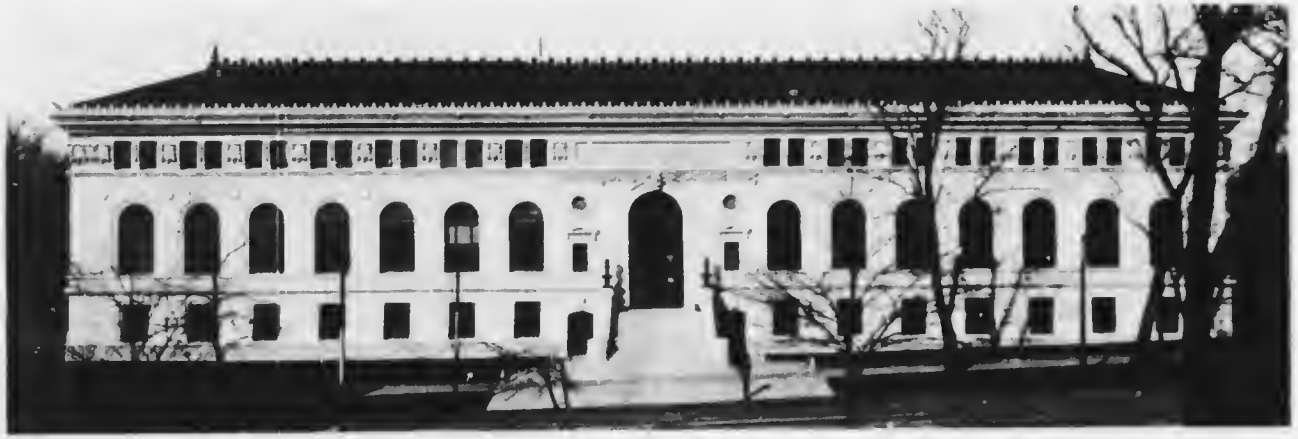


Fig. 236 VIEW OF ENTRANCE FRONT

Fig. 236 RICE HALL, WITH ATTENDANTS DESK

SPRINGFIELD CITY LIBRARY

SPRINGFIELD, MASS

EDWARD L. TILTON, Architect

HILLER C. WELLMAN, Librarian

Rice Hall, so called for William Rice, librarian from 1861 to 1897, is at the west of the rotunda and serves as the main book room of the library. The general storage stack is directly below and connects with Rice Hall by means of stairways and a book lift. The office of the librarian, secretaries' and stenographers' rooms, and a directors' room are on the mezzanine floor over the radial bookstack.

Fig. 237 VIEW IN FIRST TIER OF STACK ROOM

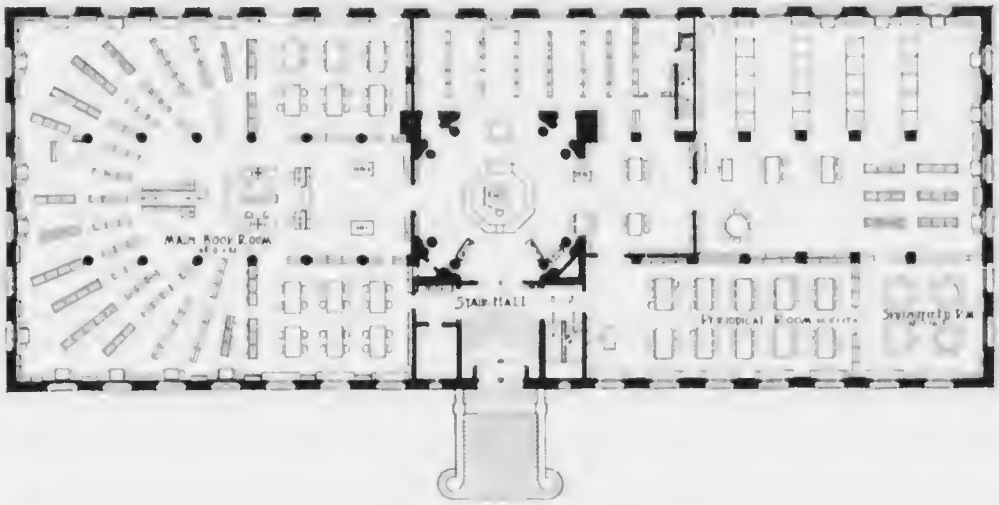


Fig. 218 FIRST FLOOR PLAN

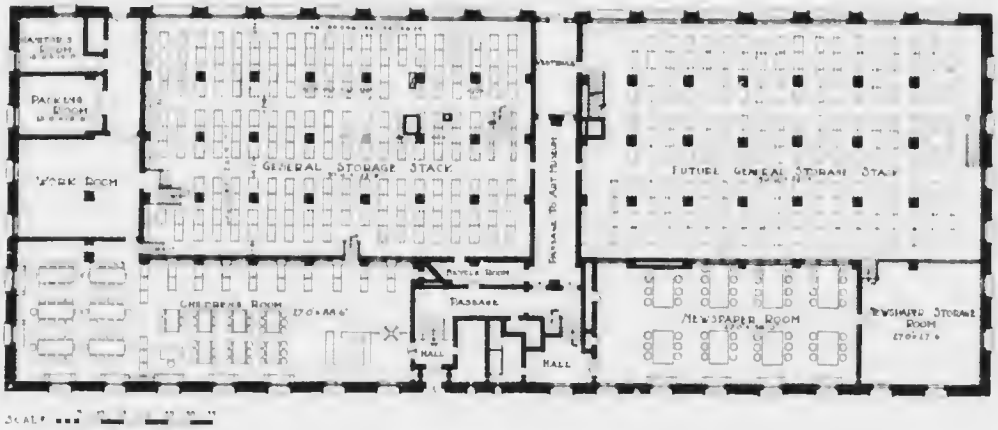


Fig. 219 BASEMENT FLOOR PLAN

SPRINGFIELD CITY LIBRARY, SPRINGFIELD, MASS

On the second floor, just above the entrance hall, is located a fireproof vault in which valuable books and papers may be stored. To the left of this are the medical library and study, and rooms for administration and cataloging. To the right are a large lecture hall and a map room. An exhibition room occupies the rear of the building on this floor.

Fig. 240 MULTNOMAH COUNTY PUBLIC LIBRARY, PORTLAND, ORE.

Doyle, Patterson & Beach, Architects Miss Mary E. Ison, Librarian

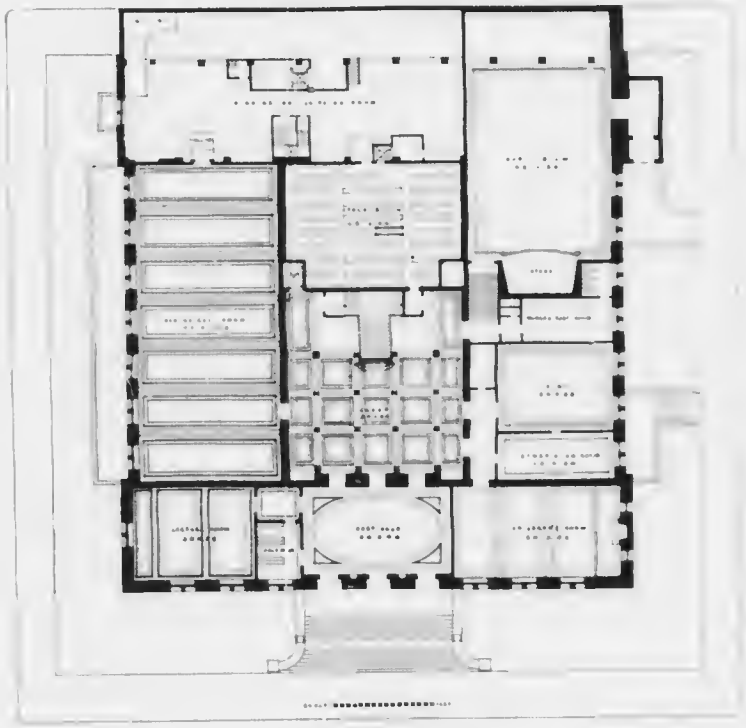


Fig 20 FIRST FLOOR PLAN

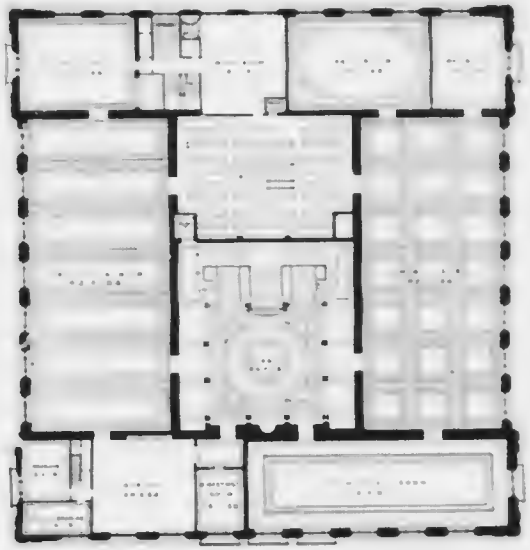


Fig 21 SECOND FLOOR PLAN

MULTNOMAH COUNTY PUBLIC LIBRARY

PORTLAND, ORE

At present the building contains a four-tier Snead Standard Stack, with provision for the addition of four more tiers above those in place. All floors of the building line up with either present stack deck floors or deck floors of proposed stack. On the third floor are the staff rooms, a dining room with kitchen adjoining, a housekeeping suite for the resident janitor, a rest room for the pages, a large room for art exhibits and displays of various sorts, and several committee rooms for the use of the public. This story also contains a lecture room and picture galleries which will ultimately be used for library purposes.

Fig. 243 TORONTO PUBLIC REFERENCE LIBRARY, TORONTO, ONTARIO

Wickson & Gregg and A. H. Chapman, Architects George H. Locke, Librarian

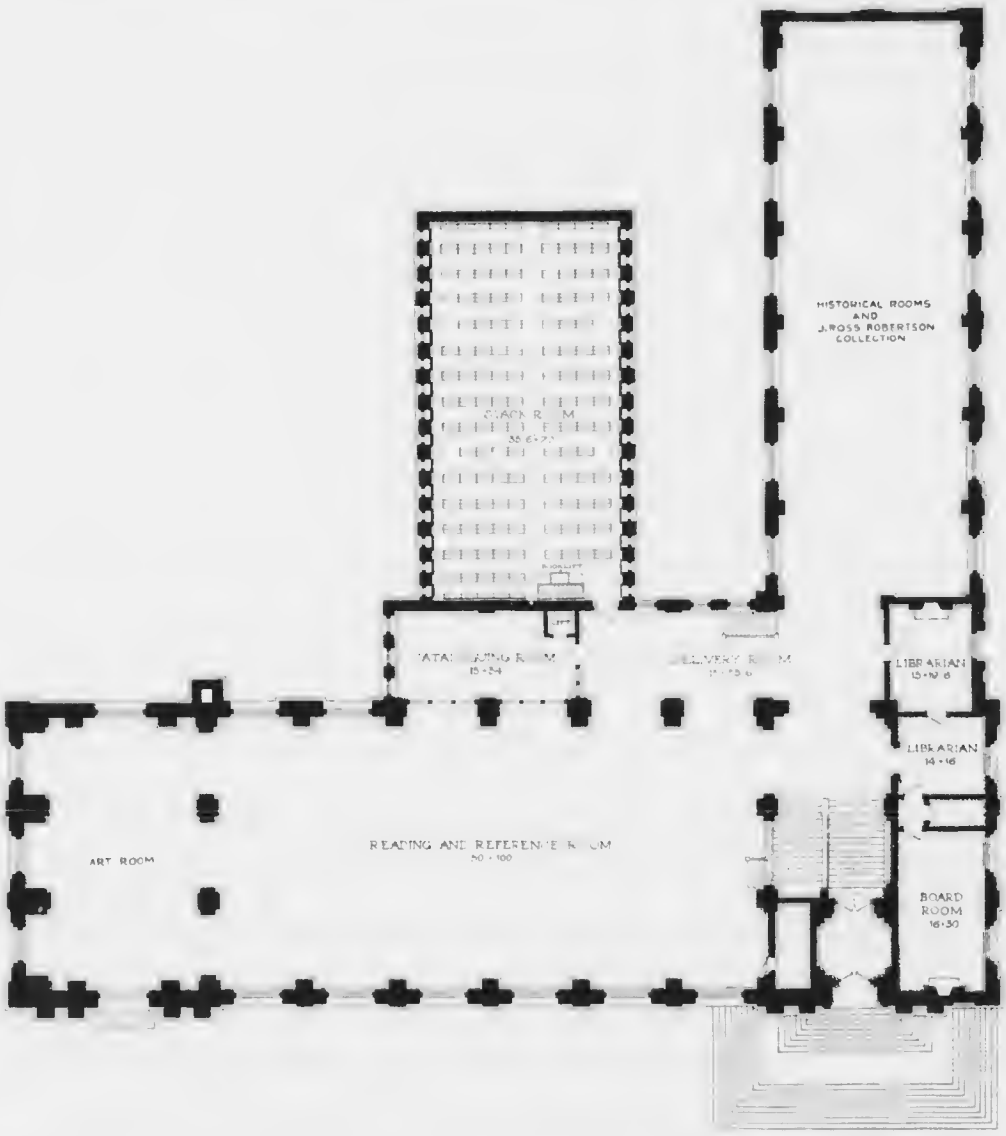


Fig. 241. TORONTO PUBLIC REFERENCE LIBRARY, TORONTO, ONTARIO

The absence of corridors and the grouping of the several departments has developed a plan with practically no waste space. The delivery room, in direct communication with every other room on the first floor, is so located as to allow complete control from this one central point, and the stack room setting free on three sides, affords an opportunity for extensive expansion.

Fig. 295 VIEW FROM THE STREET

Fig. 296. BOOKSTACK AND DELIVERY DESK

DENVER PUBLIC LIBRARY, DENVER, COLO.

ALBERT RANDOLPH ROSS, Architect CHALMERS HADLEY, Librarian

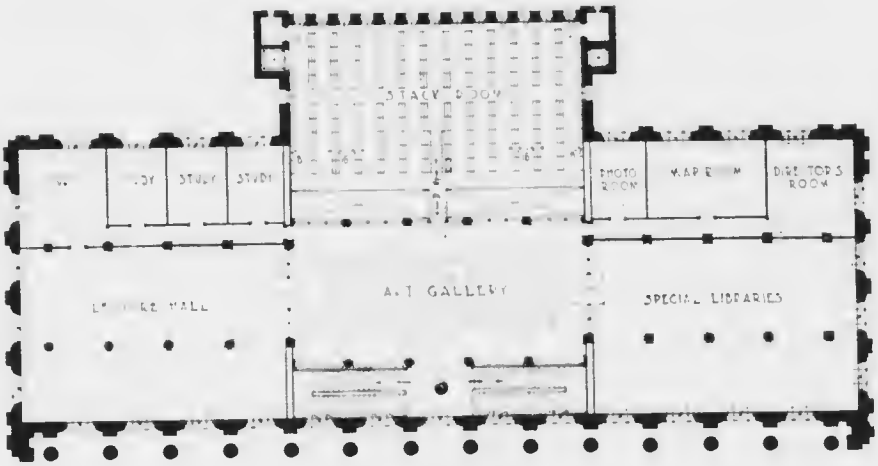
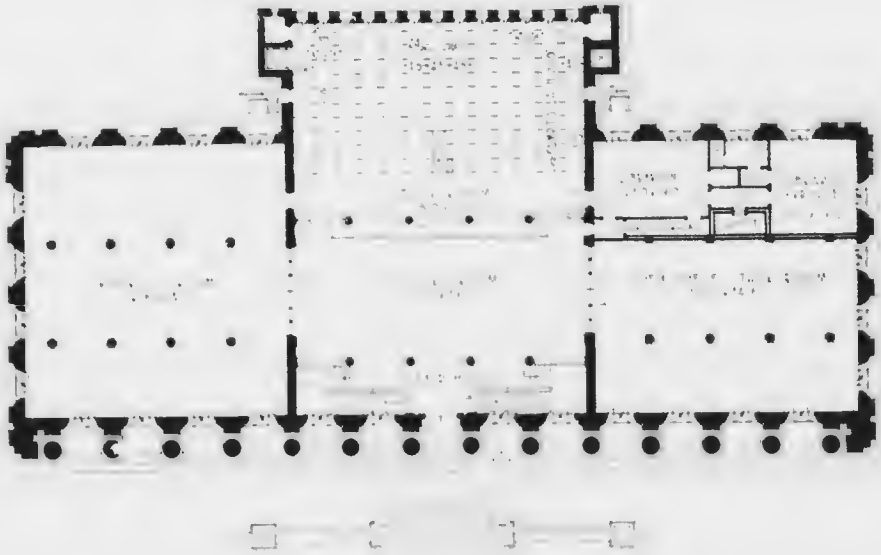


Fig. 217 SECOND FLOOR PLAN



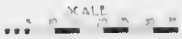


Fig. 218. FIRST FLOOR PLAN

DENVER PUBLIC LIBRARY, DENVER, COLO.

Fig. 249 VIEW FROM STREET

Fig. 250 VIEW OF DELIVERY ROOM

BROOKLINE PUBLIC LIBRARY, BROOKLINE, MASS.

R. Clipston Sturgis, Architect Miss Louisa M. Hooper, Librarian

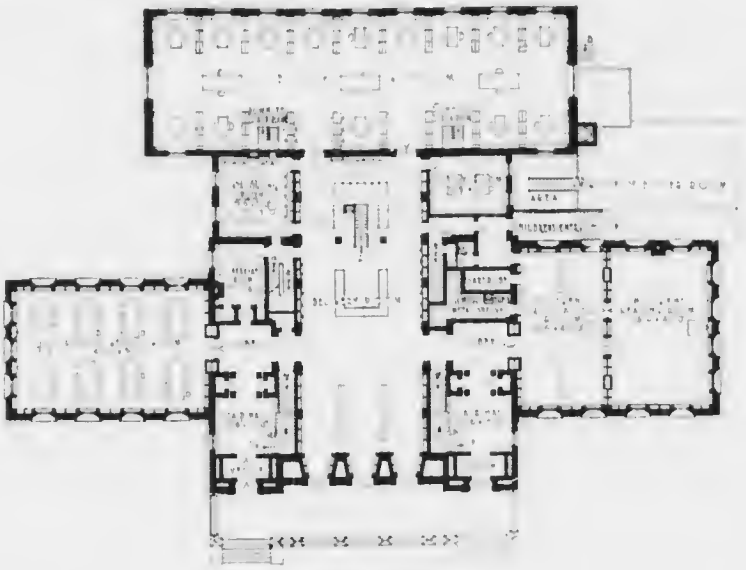


Fig. 251 FIRST FLOOR PLAN

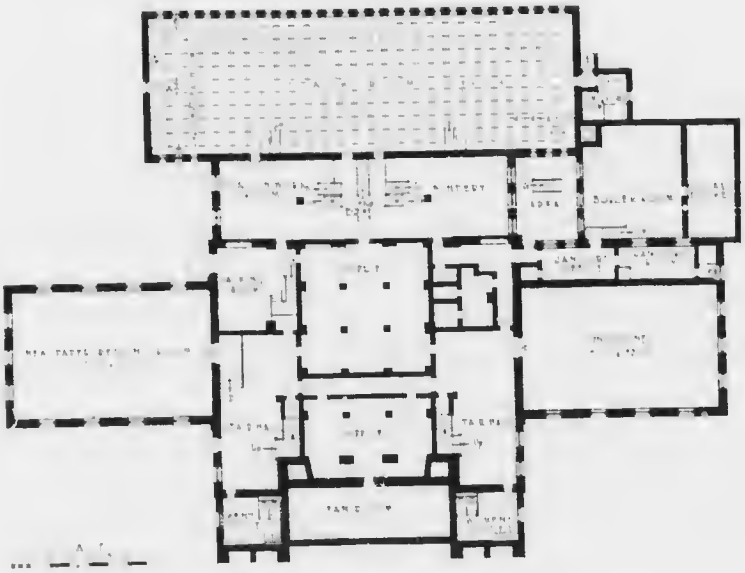


Fig. 252 BASEMENT FLOOR PLAN

BROOKLINE PUBLIC LIBRARY, BROOKLINE, MASS.

The reading room floor is carried by the two tier Snead Standard Stack in the basement.

Fig. 2 ENTRANCE VIEW

Fig. 24 VIEW IN SECOND STACK TIER

BEVERLY PUBLIC LIBRARY, BEVERLY, MASS

CASS GILBERT, Architect MISS MARTHA P. SMITH, Librarian

The view in the bookstack shows marble deck floors, double-paneled range fronts, and lift enclosure with steel ledge and wire mesh panels

Fig. [illegible] SECOND FLOOR PLAN

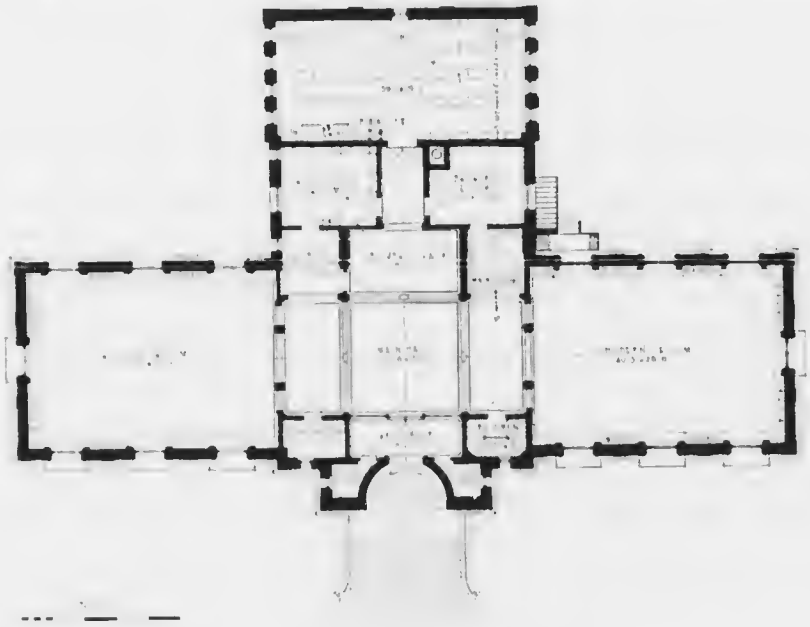


Fig. [illegible] MAIN FLOOR PLAN

BEVERLY PUBLIC LIBRARY, BEVERLY, MASS

The building has been planned to allow extension of the stack, not only by adding tiers, but also by increasing the number of ranges in each tier by extending to the rear.

Fig. 7 ENTRANCE VIEW

Fig. 8 VIEW IN TOP TIER OF STACK ROOM

GARY PUBLIC LIBRARY, GARY, IND.

H. D. Whitehouse, Architect — Louis J. Bailey, Librarian

The floor of the reading room, directly above the stack room, is carried by the shelf supports of the Snead Standard Stack

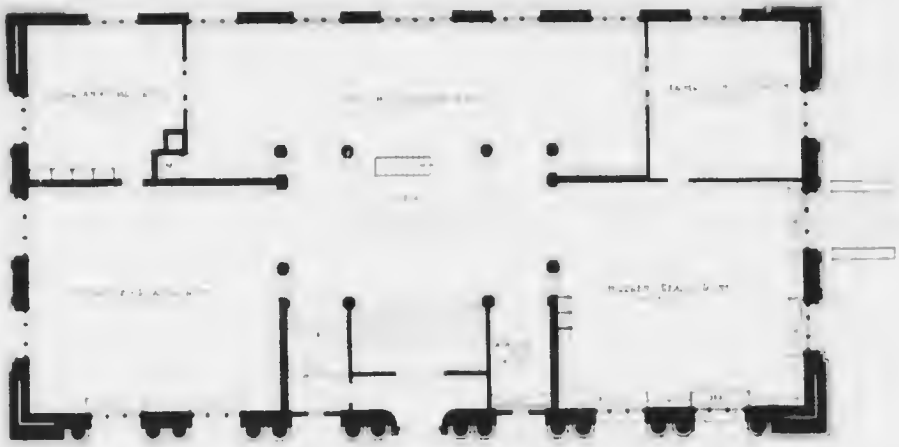


Fig. 29 FIRST FLOOR PLAN

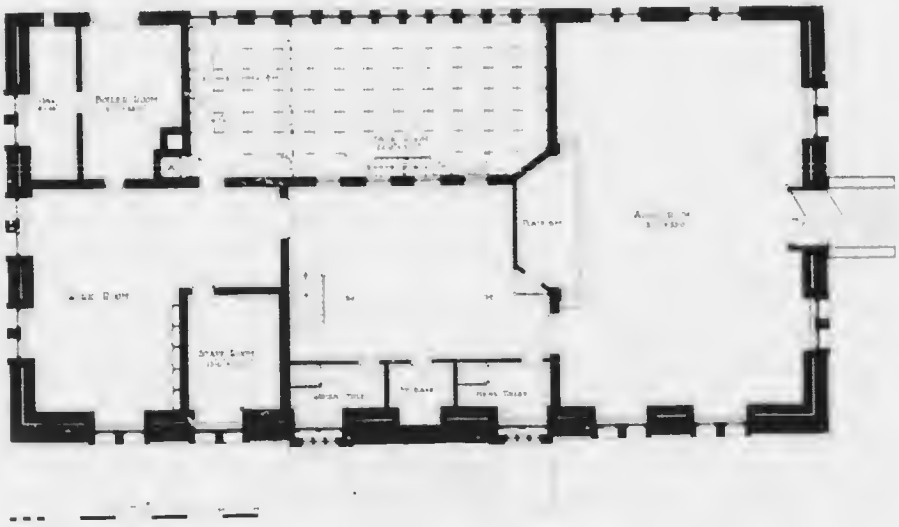
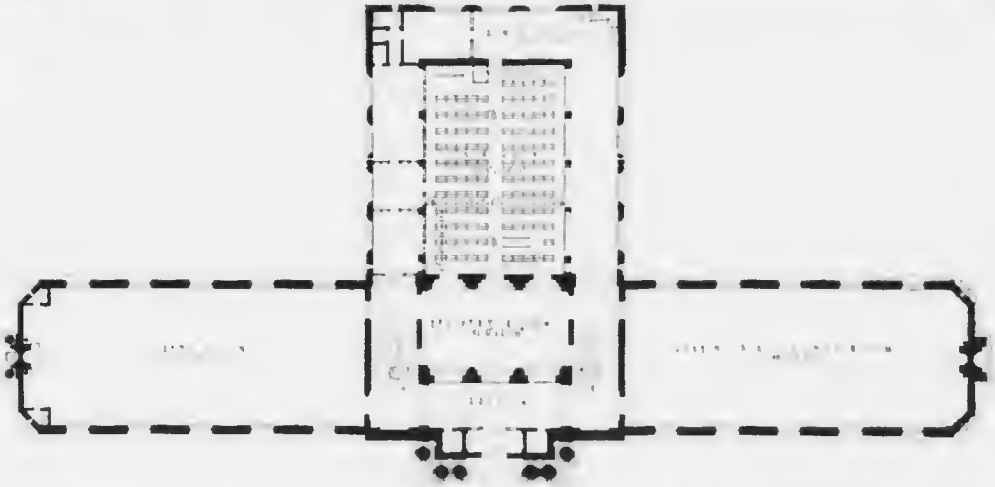


Fig. 30 BASEMENT FLOOR PLAN

GARY PUBLIC LIBRARY, GARY, IND

Gary has been growing so rapidly that the Carnegie appropriation was increased before the library building was commenced. Future expansion of the building is planned by adding new wings at each end.



FIRST FLOOR PLAN

LOUISVILLE PUBLIC LIBRARY, LOUISVILLE, KY

PRIDDIE & TACHAU, Architects — GEORGE T. SETTLE, Librarian

On the second floor are located children's, class, study and art rooms; the third story contains a museum. Clerestory windows light the two upper tiers of the stack room. In the basement are janitor's and service rooms, a lecture hall and a newspaper and public documents room. The electric switches in the stack room control the lights under the glass floors of each tier.

Fig. 26 ENTRANCE VIEW

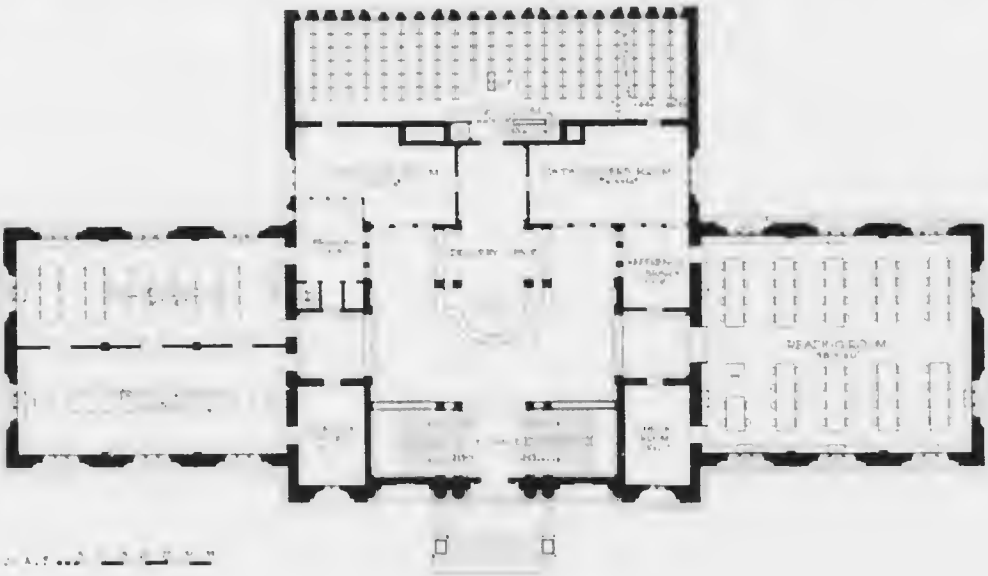


Fig. 261 FIRST FLOOR PLAN

PUBLIC LIBRARY, WASHINGTON, D. C.

ALBERT RANDOLPH ROSS, Architect GEORGE F. BOWERMAN, Librarian

A large Memorial Hall occupies the central space in the second story; the left wing contains a lecture hall and the right wing is used for newspapers and periodicals. This story also contains the upper part of the stack, trustees' room and several study rooms.

Fig. [illegible] VIEW OF INTERIOR DURING CONSTRUCTION

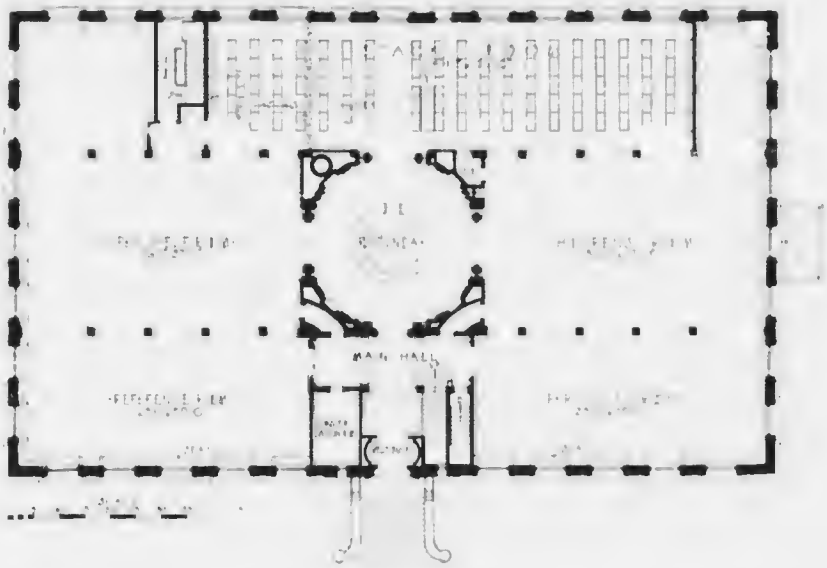


Fig. [illegible] FIRST FLOOR PLAN

MANCHESTER PUBLIC LIBRARY, MANCHESTER, N. H.

Edward L. Tilton, Architect — Miss F. Marie Winchell, Librarian

The stack room, extending through the basement and first stories, is open to the readers.

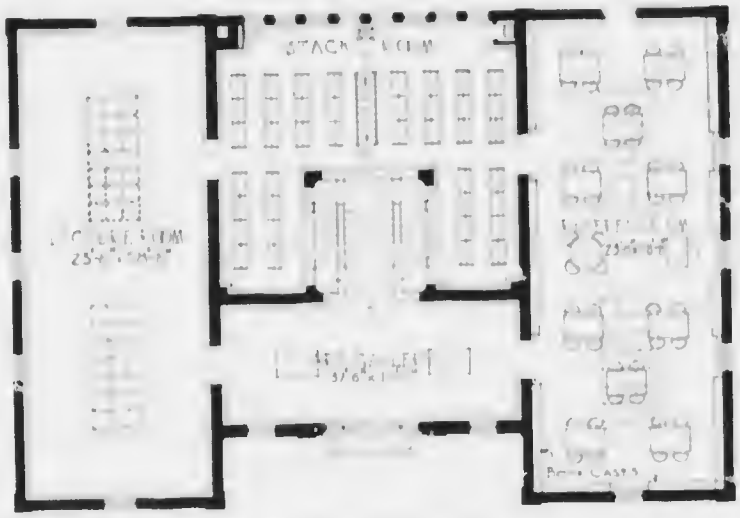


Fig. 268 SECOND FLOOR PLAN

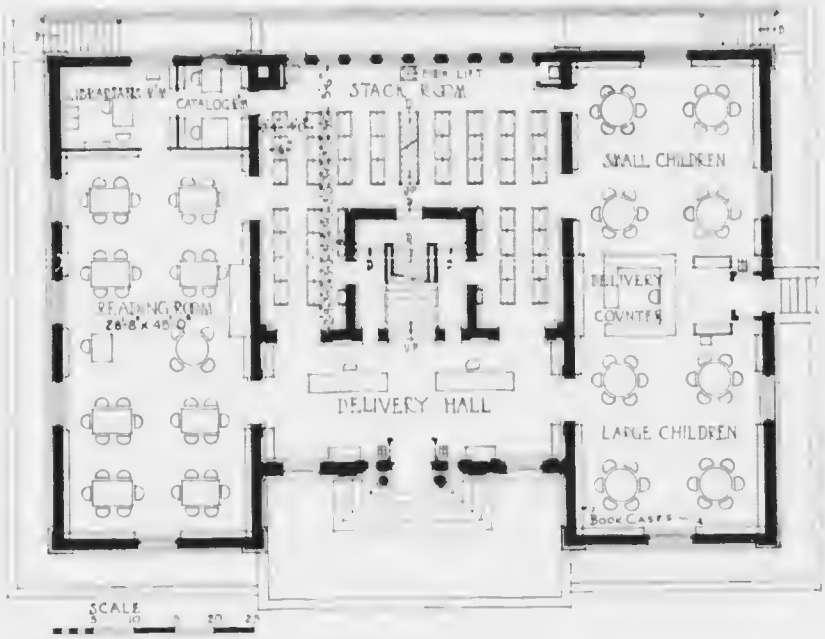


Fig. 269 FIRST FLOOR PLAN

NEW ROCHELLE PUBLIC LIBRARY, NEW ROCHELLE, N. Y.

ALBERT RANDOLPH ROSS, Architect — MISS JESSIE BRAINERD, Librarian

The stack room forms the central feature about which the other rooms have been planned.

Fig. 260

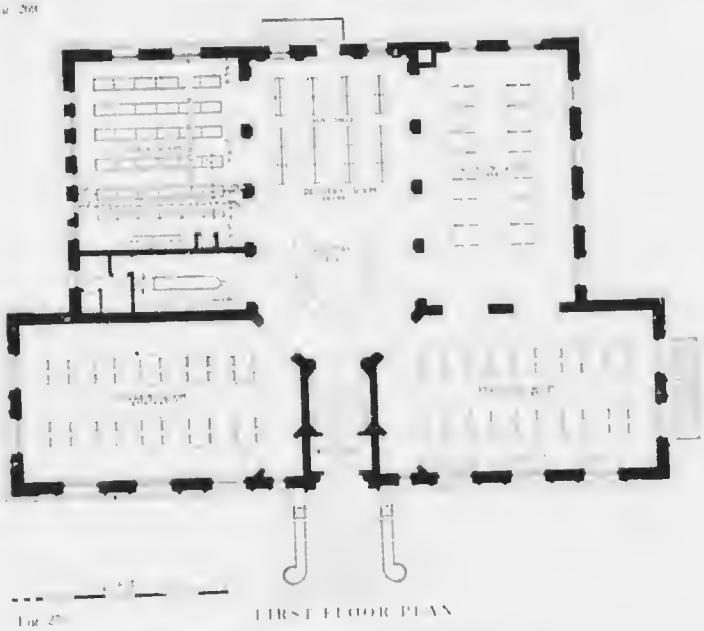


Fig. 27 FIRST FLOOR PLAN

ELIZABETH PUBLIC LIBRARY, ELIZABETH, N. J.

EDWARD L. TILTON, Architect — GEO. A. GREENE, Editorial

The four tier Snead Standard Stack supports the floor of the medical library above. The basement story contains the lower part of stack, lecture room, staff room, work and store rooms. On the second floor are executive and administrative offices, cataloging, special study and exhibition rooms, and six rooms for special collections.

Fig. 271. REPRODUCTION FROM ARCHITECT'S PERSPECTIVE

Building in course of construction, 1914

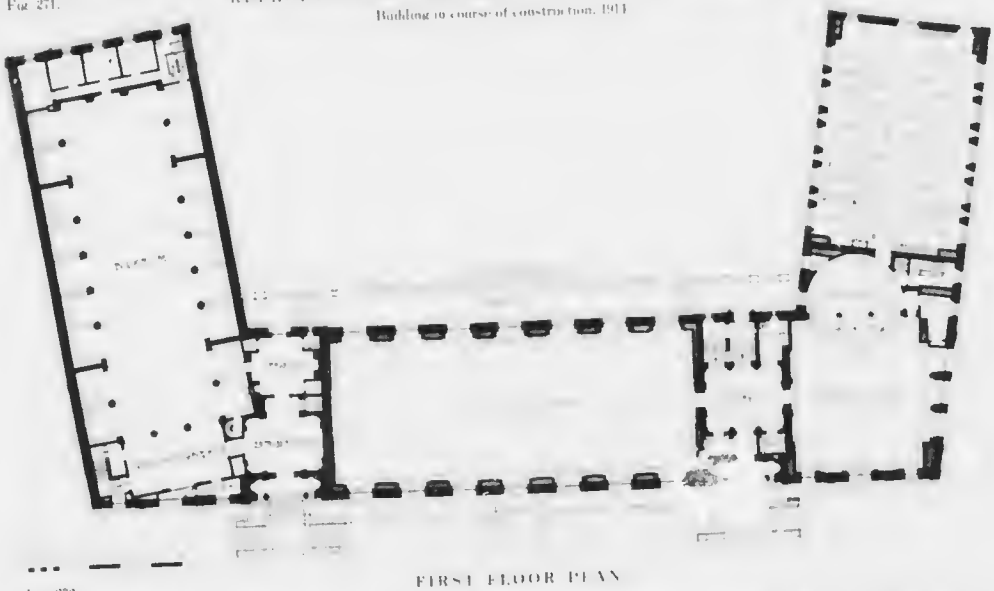


Fig. 272 FIRST FLOOR PLAN

MR. JAS. J. HILL'S REFERENCE LIBRARY AND ST. PAUL PUBLIC LIBRARY, ST. PAUL, MINN.

W. DAWSON JOHNSTON, Librarian

ELLETUS D. LITCHFIELD, Architect

Although under one roof, these libraries are, in effect, separate institutions and will be administered as such. While Mr. Hill's Library will contain a private collection and will be supported by him, it is understood that it will be free to public use. This library will consist, in the main, of one great room with three tiers of galleries. The St. Paul Public Library will contain, besides those rooms usually required, a children's auditorium, a binding and printing department, a room for the blind, a kitchen, lunch and sitting room for the staff, and a staff class room with studies adjoining. A feature of the plan is the direct communication between departments and the absence of wasteful hall space. This is the last building on which the late Charles C. Soule acted in an advisory capacity.

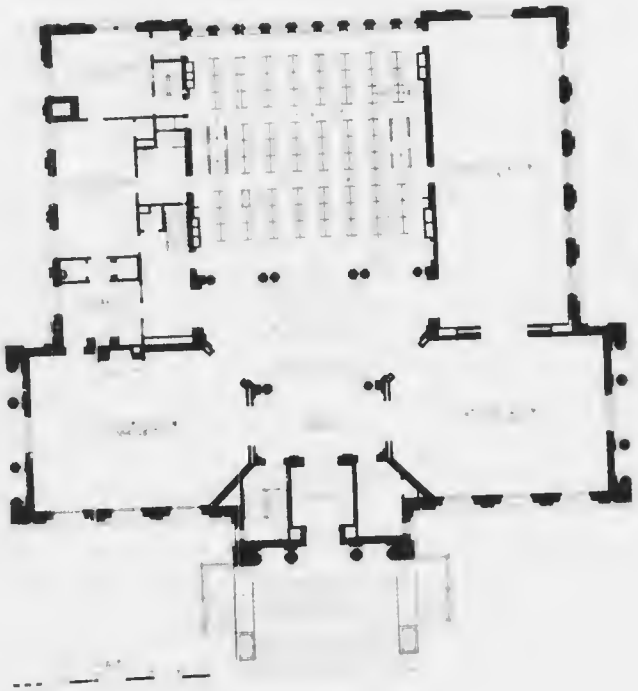


Fig. [illegible] FIRST FLOOR PLAN

Fig. 274 FRONT VIEW

EVANSTON PUBLIC LIBRARY
EVANSTON, ILL.

James Gamble Rogers and
Chas. A. Phillips, Archts.

Miss Mary R. Lindsay
Librarian

The three walls of the stack room are laid up in a light, buff colored face brick with all external angles rounded. At the left of the stack room there is a mezzanine story containing the directors' room, music room, staff room and a lavatory. The basement contains a lecture room designed to accommodate one hundred and fifty people, a room for the Evanston Historical Society, a boys' room, janitor's quarters, lavatory, heating and ventilating plant and unpacking room.

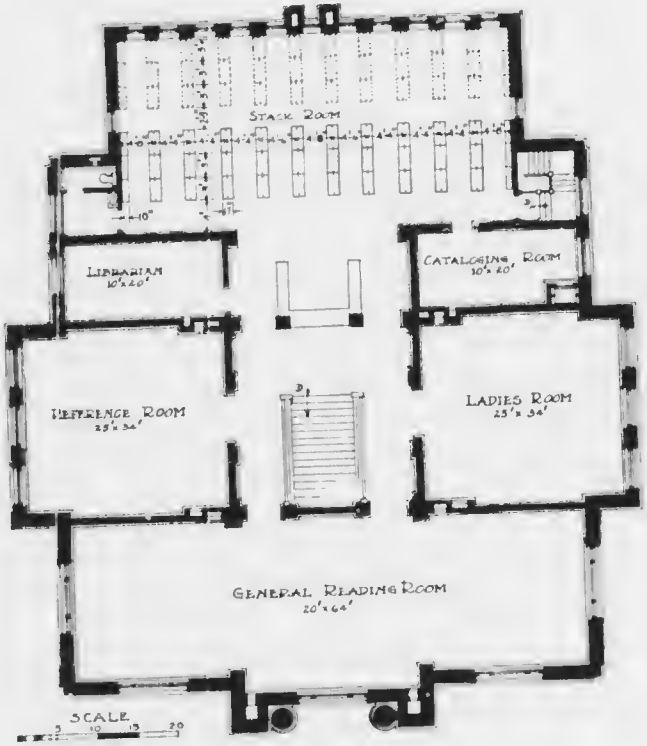


Fig. 255 MAIN FLOOR PLAN

Fig. 256 VIEW FROM VICTORIA SQUARE

REGINA PUBLIC LIBRARY
REGINA, SASKATCHEWAN

STOREY & VAN LEMOND, Architects J. R. C. HONYMAN, Librarian

The stack room contains a single tier of Snead Standard Stack with provision for a future second tier. Other rooms are equipped with Snead Unit System wall shelving. On the ground floor are located a children's department and lecture room, a repair room, toilets, janitor's quarters and boiler room. Indirect illumination is employed throughout the building.

Fig. 27 EXTERIOR VIEW

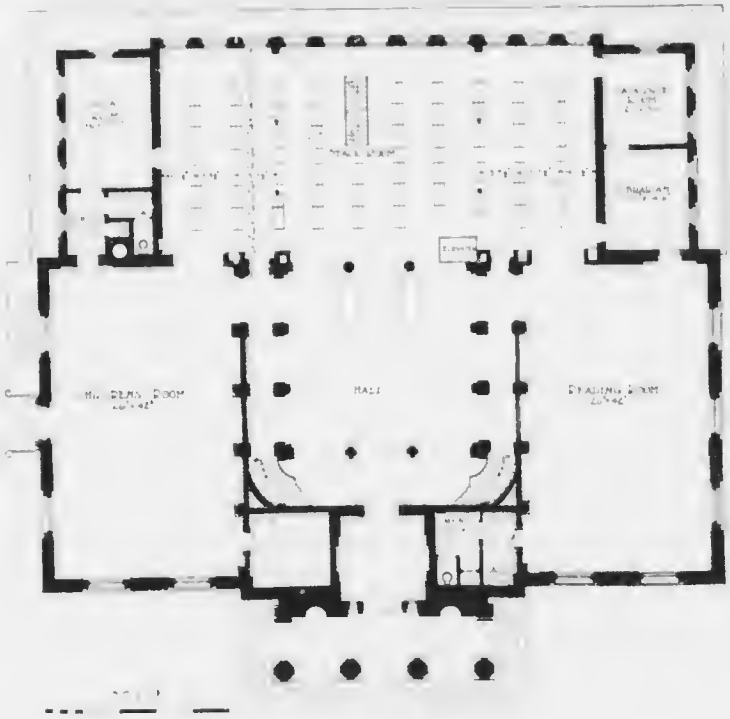


Fig. 278 FIRST FLOOR PLAN

PERCUSON MEMORIAL LIBRARY, STAMFORD, CONN.

TRACY, SWARTWOUT & LITCHFIELD, Architects Miss ALICE M. COLE, Librarian

On the second floor are located a small exhibition hall and a general reference room.

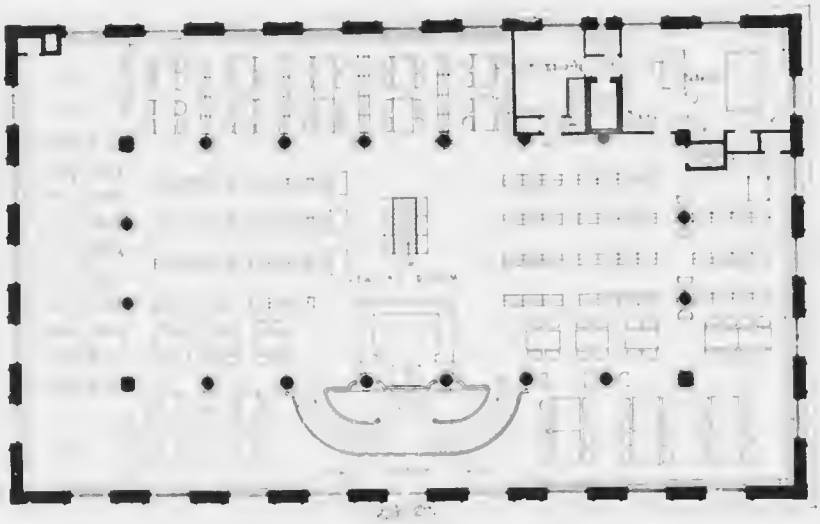


Fig. 279. FIRST FLOOR PLAN

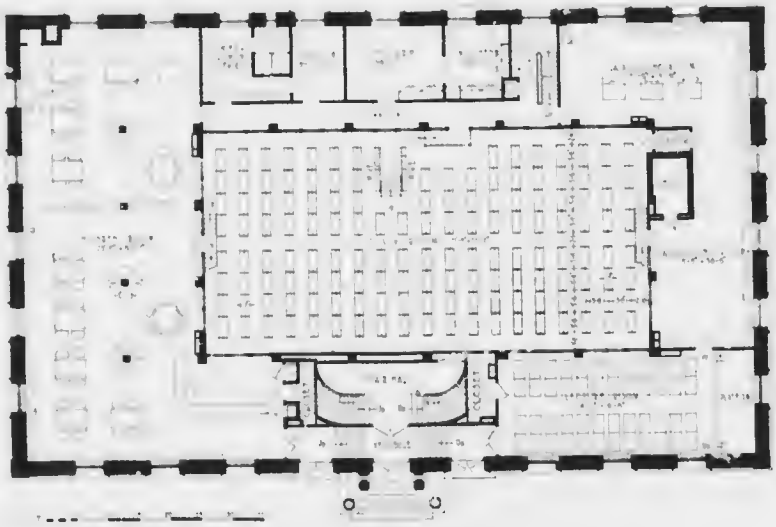


Fig. 280 BASEMENT FLOOR PLAN

SOMERVILLE FREE PUBLIC LIBRARY, SOMERVILLE, MASS.

EDWARD L. TILTON, Architect DREW B. HALL, Librarian

The two-tier Snead Standard Stack, carrying the delivery room floor above, occupies the center of the basement story, which space could be put to no other use owing to its lack of direct natural light. Note that the main floor consists of but one great room, with glass partitions in one corner, enclosing the librarian's offices.

Fig. 58 ENTRANCE VIEW

Fig. 59 FIRST STACK TIER

MOOSE JAW PUBLIC LIBRARY, MOOSE JAW, SASK

REID & MCALPINE, Architects A. H. GIBBARD, Librarian

Fig. 281 FRONT VIEW

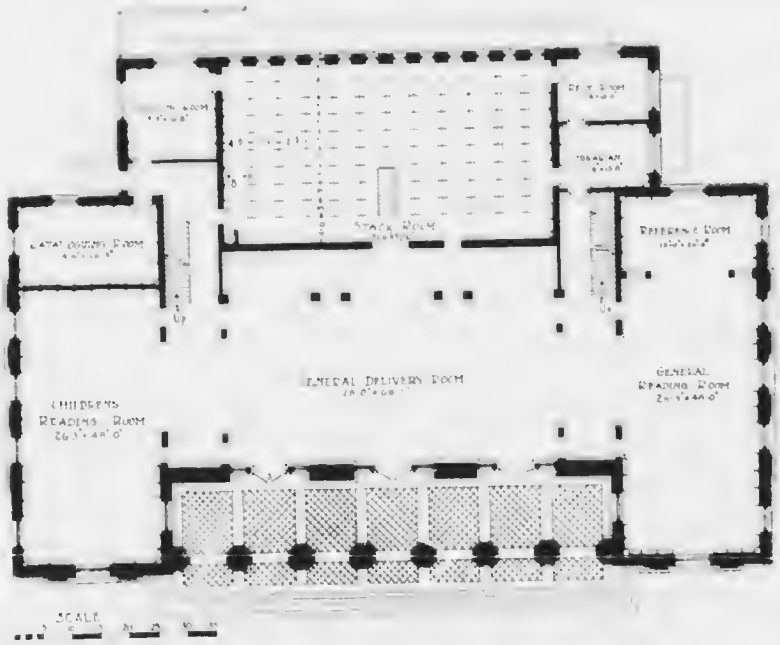
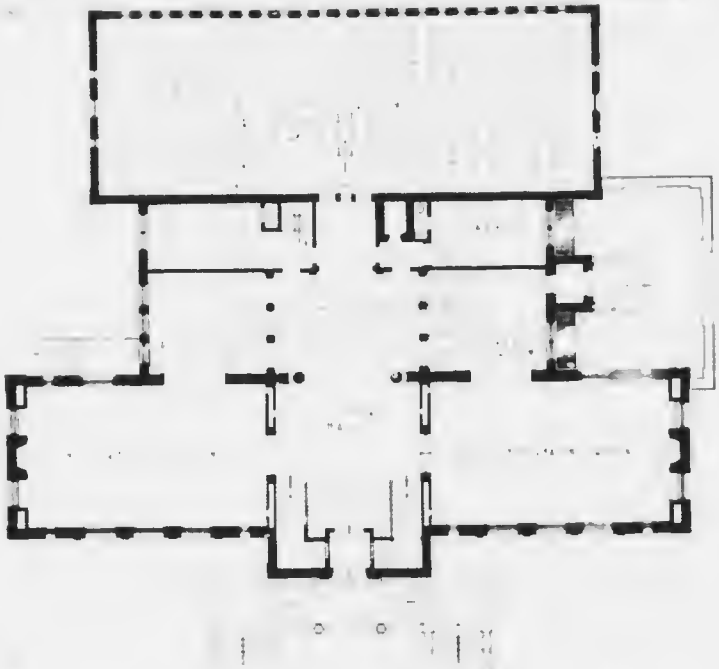


Fig. 281 FIRST FLOOR PLAN

LIBRARY OF HAWAII, HONOLULU, T. H.

HENRY D. WHITFIELD, Architect — MISS E. J. ALLYN, Librarian

The two-tier Snead Standard Stack supports the "lanai" or open air reading room above. Second story contains an auditorium, Hawaii Historical Society room, club room and a children's story room.



MAIN FLOOR PLAN

BANGOR PUBLIC LIBRARY, BANGOR, ME.

PEABODY & STEARNS, Architects — CHAS. A. FLAGG, Librarian

Stack room designed to accommodate four tiers of stack. At the outset only the second tier, as seen above, was installed over the bare steel columns of the first tier. Later the central portion of the first tier was equipped with shelf supports and shelves.

Fig. 287

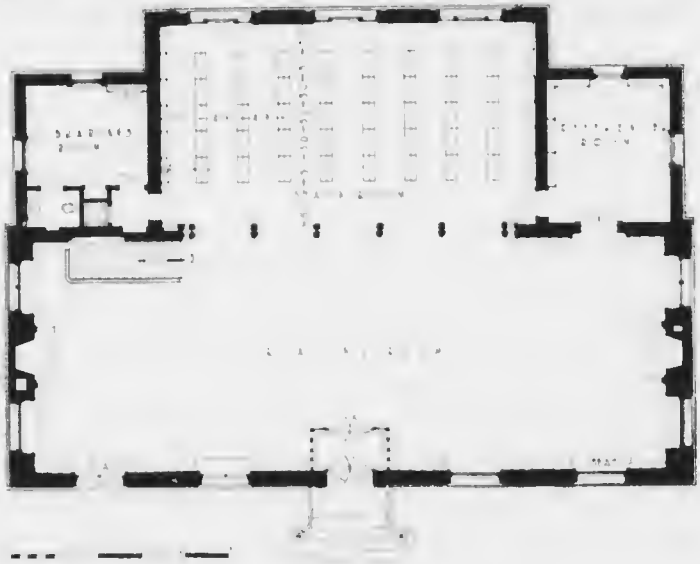


Fig. 288. FIRST FLOOR PLAN

MASON LIBRARY, GREAT BARRINGTON, MASS.

BLANCHARD & BARNES, Architects MISS EMMA W. SHELDON, Librarian

The single tier of Snead Standard Stack, with solid paneled range fronts, has a removable steel cornice so that a second tier may be conveniently installed when required.

Fig. 29 MAIN FLOOR PLAN

OTTAWA PUBLIC LIBRARY, OTTAWA, ONT.

Edgar I. Holwood, Architect W. J. Sykes, Librarian

Fig. 30 INTERIOR OF STACK

The stack room was originally equipped with a bracket stack which, when expansion became necessary, was found to be too weak to carry a second tier. A Special Standard Stack was therefore installed for a first tier and the bracket stack reset above it as a second tier. This moving and resetting of the bracket stack will have to be repeated when the third tier is required.

Fig. 79 FRONT VIEW OF EXTERIOR

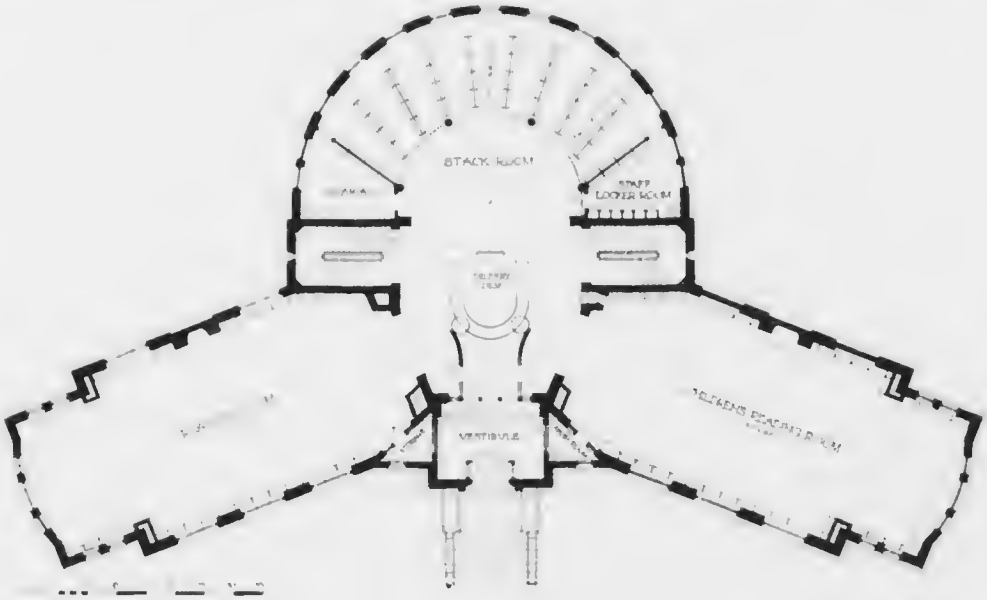


Fig. 80 FIRST FLOOR PLAN

WILLIAMSBURG BRANCH LIBRARY, BROOKLYN, N. Y.

WALKER & MORRIS, Architects FRANK P. HILL, Librarian

This is the largest of the Brooklyn branches of the Carnegie library system. The delivery desk forms a focal point from which the librarian has absolute supervision, including even the radial aisles in the two-tier stack. The change of axis gives a distinct separation between the children's and the reading rooms. The basement contains a lecture hall with stage, anterooms and toilet under the reading room, work and storage rooms under the children's room; and toilets, boiler room, and fan under the stack.

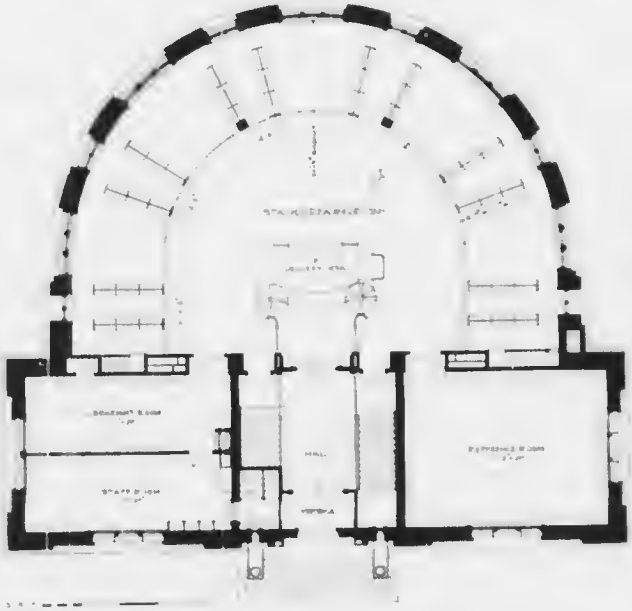


Fig. 293 FIRST FLOOR PLAN

Fig. 294 ENTRANCE VIEW

PACIFIC BRANCH LIBRARY BROOKLYN N Y

RAYMOND F. ALMIRALL, Architect FRANK P. HILL, Librarian

In the basement the entire area under the stack and reading rooms is devoted to a well lighted lecture room with anterooms and janitor's quarters. The front of the building on this floor is devoted to machinery and boiler rooms, work rooms and toilet. The second floor contains the children's room above the twotier stack and two study rooms in the front of the building.

Fig. 295

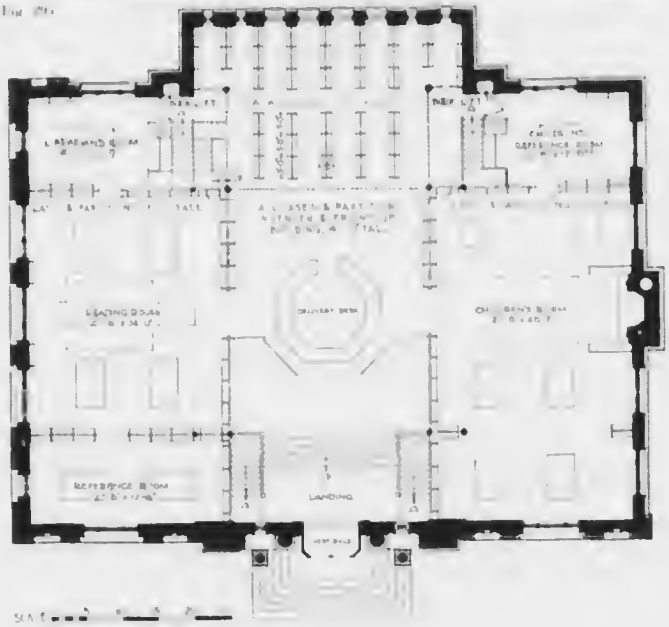


Fig. 296 FIRST FLOOR PLAN

CARROLL PARK BRANCH LIBRARY, BROOKLYN, N. Y.

WM. B. TUBBY & BRO., Architects FRANK P. HILL, Librarian

Directly under the stack room and delivery desk, is located a stage and auditorium with direct access to the street. To the left are three large study rooms and to the right a staff room, work room, janitor's quarters, and lavatories.

Fig. 297 VIEW OF EXTERIOR

Fig. 298 STACK AND READING ROOM

LOUIS GEORGE BRANCH LIBRARY, KANSAS CITY, MO

CHAS. A. SMITH, Architect F. B. WRIGHT, Librarian

The open shelf principle is here fully developed as the stack room is entirely open to the readers and forms the principal architectural feature of the interior

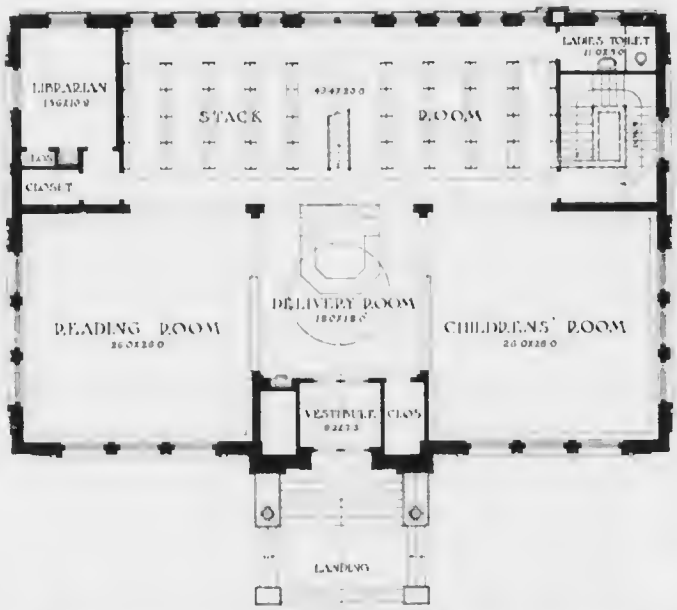


Fig. 299 FIRST FLOOR PLAN

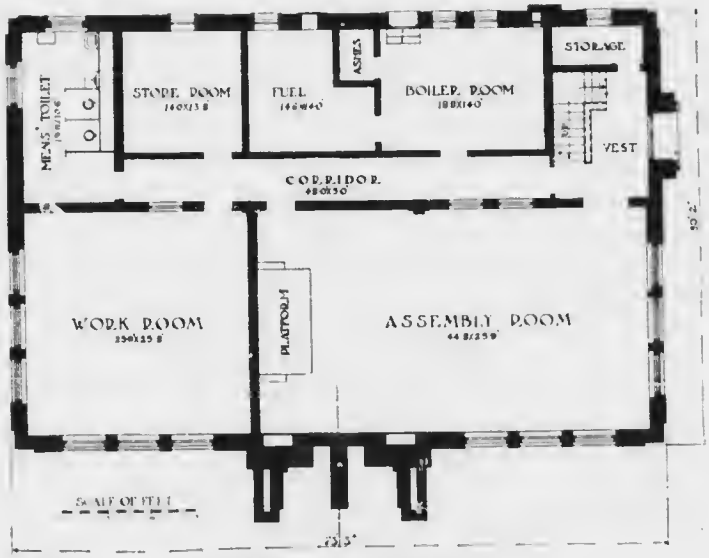


Fig. 300 BASEMENT FLOOR PLAN

LUCIUS GEORGE BRANCH LIBRARY, KANSAS CITY, MO.

Note that the assembly room in the basement may be reached through a side entrance directly from the street, without passing through the library proper.

Fig. 91

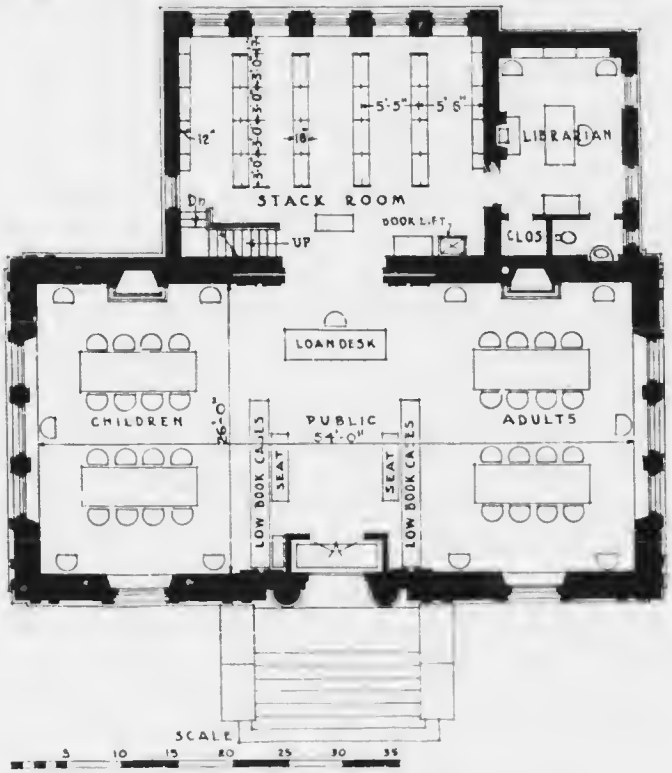


Fig. 92 FIRST FLOOR PLAN

SOUTHBORO PUBLIC LIBRARY, SOUTHBORO, MASS.

ALFRED COOKMAN CASS, Architect MISS FRANCENA E. BECK, Librarian

Basement floor contains stack room, public documents and unpacking rooms, boiler room and storage space.

Fig. 303 ENTRANCE VIEW

Fig. 304 DELIVERY ROOM, WITH STACK AT LEFT

PROCTOR PUBLIC LIBRARY, PROCTOR, VT.

HARRY LESLIE WALKER, Architect MARY K. NORTON, Librarian

The stack room, placed directly opposite the entrance, contains a two-tier Snead Standard Stack with colonial design range fronts.

Fig. 105.

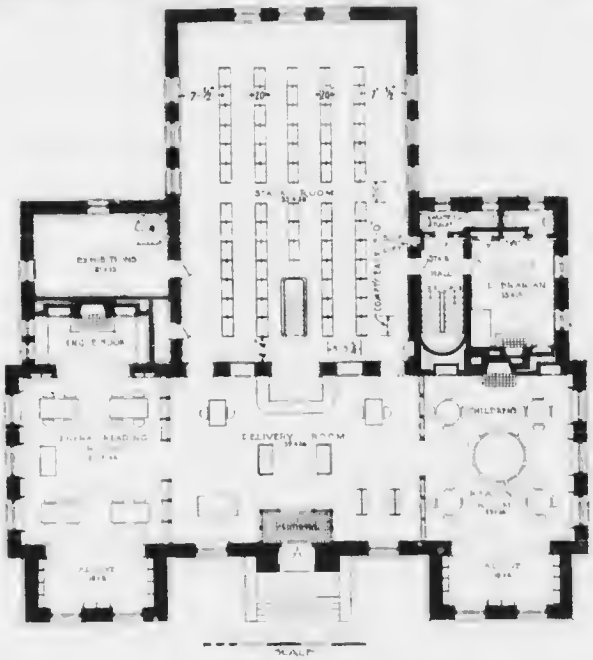


Fig. 106 FIRST FLOOR PLAN

WHITINSVILLE PUBLIC LIBRARY, WHITINSVILLE, MASS.

R. CLIPSTON STURGIS, Architect Mrs. W. H. Fetter, Librarian

The two-tier Snead Standard Stack is contained in the basement and first stories and carries the roof above it. Besides the boiler and storage rooms, the basement also contains a bindery, an unpacking and branch room and a large working space.

Fig. 307 VIEW OF EXTERIOR

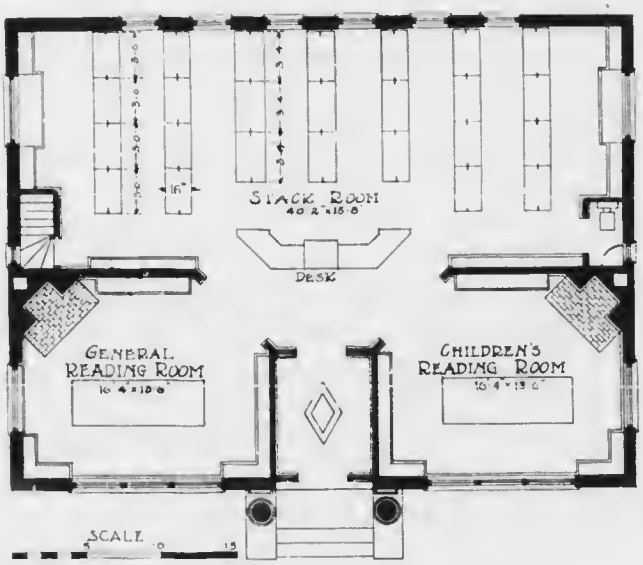


Fig. 308 MAIN FLOOR PLAN

NEWTOWN PUBLIC LIBRARY, NEWTOWN, PA

HENRY I. REINHOLD, JR., Architect W. E. MARTINDALE, Librarian

This shows a typical plan for a small town library. The floor space has been divided into three units: stack room, general reading room and children's reading room, arranged in such manner as to allow supervision by a single attendant. Provision has been made for the addition of another tier of Snead Standard Stack

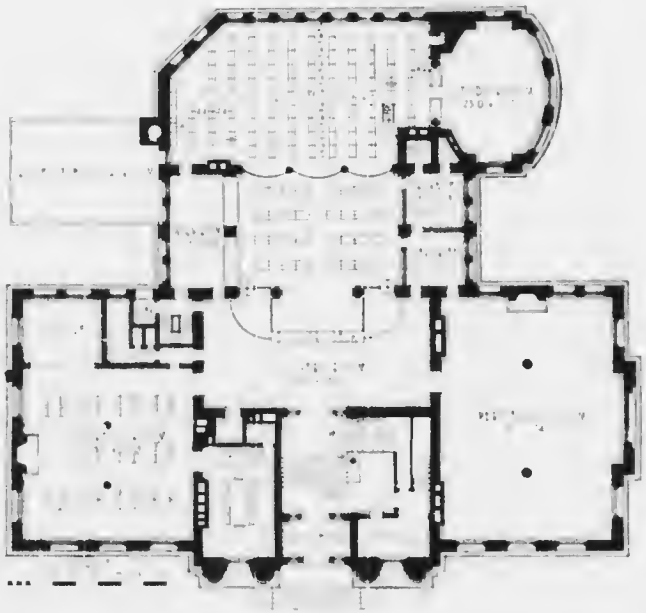


Fig. [illegible] FIRST FLOOR PLAN

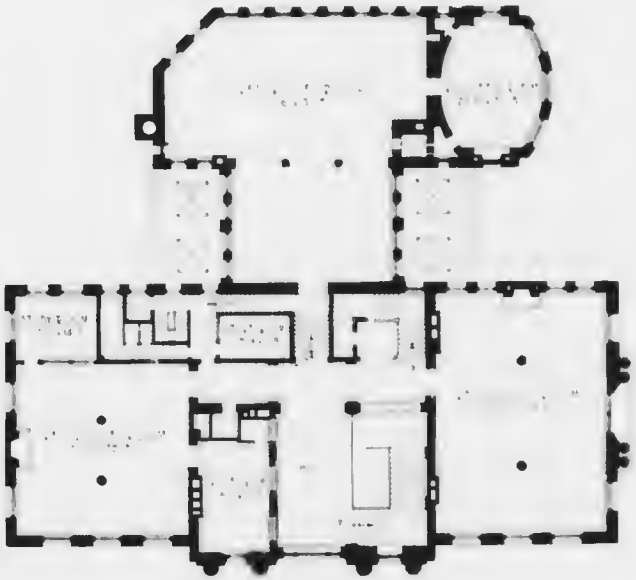


Fig. [illegible] SECOND FLOOR PLAN

SYRACUSE PUBLIC LIBRARY, SYRACUSE, N. Y.

JAMES A. RANDALL, Architect EZEKIEL W. MUNDY, Librarian

PARLIAMENTARY AND STATE LIBRARIES

BRITISH COLUMBIA PARLIAMENTARY LIBRARY

ONTARIO LEGISLATIVE LIBRARY

ARKANSAS STATE CAPITOL

WISCONSIN STATE CAPITOL

SUPREME COURT LIBRARY, SALEM, OREGON

Fig. 311. BRITISH COLUMBIA PARLIAMENT BUILDINGS, VICTORIA, B. C.

F. M. RATTENBURY, Architect. E. O. S. SCHOLEFIELD, Librarian.

Perspective rendering showing the new south front with the library wing in the center. To the left and right are the proposed departmental and museum buildings. The main floor of the library wing has been placed in the second story so as to be on a level with the legislative rooms of the main building. The larger part of the basement and first story is devoted to a four tier Snead Standard Stack, the south portion of which extends into the second story, forming a six tier stack. This extension provides space for a large number of books close to the delivery desk. As necessitated by the purposes of a legislative library, the book space predominates, the space allotted to the public being comparatively small.

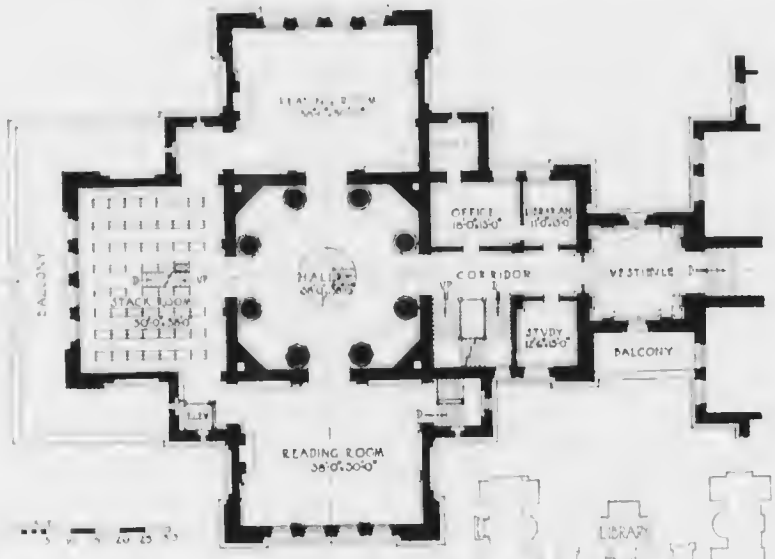


Fig. 312. SECOND FLOOR OF LIBRARY WING SHOWING
UPPER TIER OF SNEAD STANDARD STACK

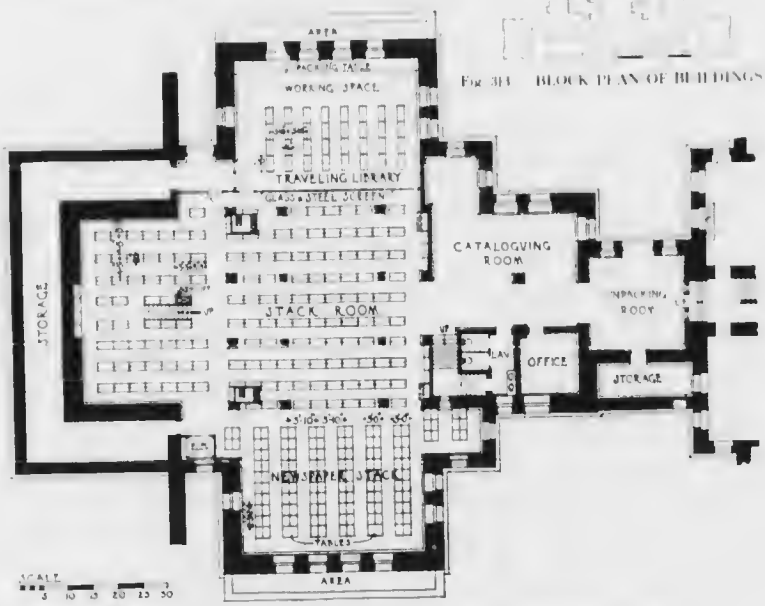


Fig. 313. BLOCK PLAN OF BUILDINGS

Fig. 313. BASEMENT FLOOR OF LIBRARY WING SHOWING FIRST
TIER OF SNEAD STANDARD STACK

BRITISH COLUMBIA PARLIAMENT BUILDINGS, VICTORIA, B. C.

Fig. VIEW FROM QUEEN'S PARK SHOWING NEW LIBRARY WING.

Fig. THIRD FLOOR PLAN OF LIBRARY WING.

ONTARIO PARLIAMENT BUILDINGS, TORONTO, ONTARIO

George W. Gouinlock, Architect — Weers Pardoe, Librarian

This wing was designed to allow the addition of future stories above. The third and fourth stories are devoted to library purposes, the administration offices being placed in the third story on a level with the legislative rooms of the main building. Each of the two stories contains a two tier Snead Standard Stack occupying the center of the floor space, while the space adjoining the windows is devoted to work and study rooms.

Fig. 317 VIEW IN LIBRARIAN'S OFFICE

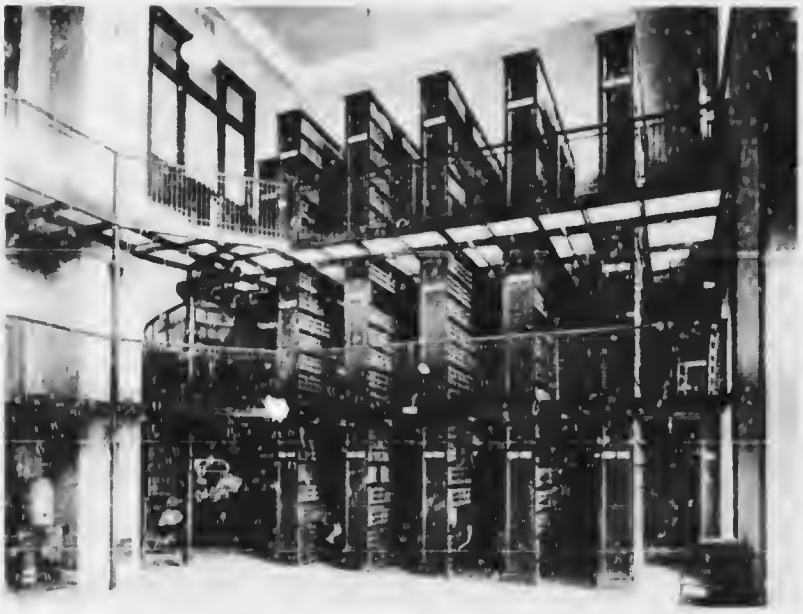
The single-faced, paneled back counter with shelving, opening on opposite side, the standing desk and the Unit System wall shelving with ledge, are all of Snead manufacture.

Fig. 318 GENERAL VIEW OF BOOKSTACK, THIRD FLOOR

A double-faced Snead Newspaper Counter entirely surrounds the stack, serving the triple purpose of a railing, a convenient storage space for bound newspaper volumes, and a long consulting table

ONTARIO PARLIAMENT BUILDINGS, TORONTO, ONT

VIEW OF EXTERIOR



SUPREME COURT LIBRARY ROOM

ARKANSAS STATE CAPITOL, LITTLE ROCK, ARK.

CASS GILBERT, Architect — PEYTON D. ENGLISH, Librarian

A three tier Snead Standard Stack is installed along two side walls, with a spiral stairway and connecting galleries. This arrangement shows how a stack room can be combined with a reading room so as to give direct access to all books.

Fig. 321 VIEW DURING CONSTRUCTION

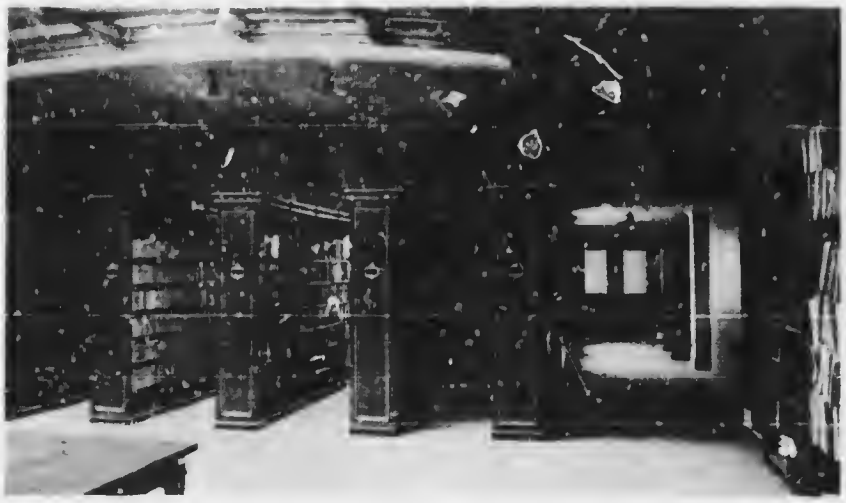


Fig. 322 UNIT SYSTEM SNEAD STANDARD STACK IN LIBRARY

WISCONSIN STATE CAPITOL, MADISON, WIS.

Geo. B. Post & Sons, Architects — Gilson G. Glazier, Librarian

The library contains a Unit System Snead Standard Stack with solid paneled range fronts, ornamental card frames, steel base and cast iron cornice. It is planned to move the library into another wing as soon as the building is completed, altering the length of stack ranges where necessary to conform to the new conditions.

Fig. 323 VIEW OF EXTERIOR

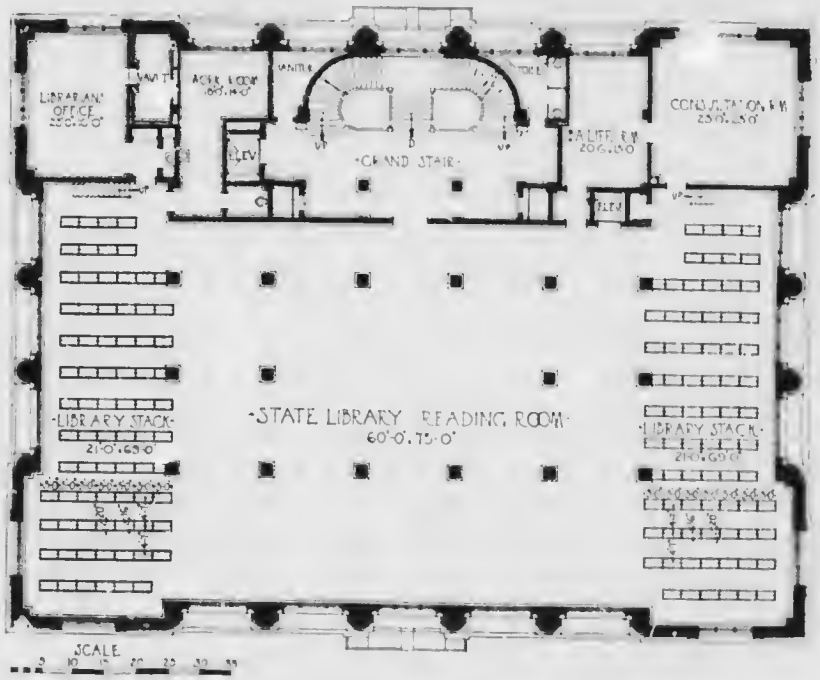


Fig. 324 LIBRARY FLOOR PLAN, SECOND STORY

SUPREME COURT AND LIBRARY BUILDING, SALEM, ORE.

W. C. KNIGHTON, Architect — MISS EDNA M. HAWLEY, Librarian

The library consists of one room with reading space in the center and a two-tier Snead Standard Stack on either side. This allows readers to work among the books and gives a spacious architectural effect.

SOCIETY AND INSTITUTE LIBRARIES

NEW HAMPSHIRE HISTORICAL SOCIETY

HISPANIC SOCIETY OF AMERICA

AMERICAN GEOGRAPHICAL SOCIETY

RHODE ISLAND MEDICAL SOCIETY

BOSTON ATHENAEUM

PHILADELPHIA COLLEGE OF PHYSICIANS

PHIPPS PSYCHIATRIC INSTITUTE

RUSSELL SAGE FOUNDATION BUILDING

MEDICAL AND CHIRURGICAL FACULTY OF MARYLAND

Fig. 325. NEW HAMPSHIRE HISTORICAL SOCIETY BUILDING, CONCORD, N. H.

GUY LOWELL, Architect OTIS G. HAMMOND, Superintendent

This building, fireproof throughout, has been given an unusually appropriate architectural design. Being a library in character, an atheneum in fact, it also expresses the dignity of a home of art and a meeting place for lectures and research. For the central rotunda, gray Sienna marble has been used in the first story and Caen stone in the second story. The staircase is of Hauteville marble. The entire left wing is devoted to the library of the Society. Books in the reading room are shelved in bronze Snead Standard Stack designed to harmonize with the architecture of the room and arranged according to the alcove system. See page 38. Adjoining the reading room are rooms for the superintendent and trustees, while the stack room is directly above. A lecture hall is contained in the right wing and above it a top-lighted, tile-paved exhibition room. Apartments for special exhibitions and loan collections are also on the second floor. The sculpture over the entrance is the work of Daniel C. French.

Fig. 326. HISPANIC SOCIETY OF AMERICA, E. L. STEVENSON, Secretary
AMERICAN NUMISMATIC SOCIETY, BAUMAN L. BELDEN, Director
CHARLES P. HUNTINGTON, Architect NEW YORK CITY

Fig. 327. AMERICAN GEOGRAPHICAL SOCIETY, NEW YORK CITY
CHARLES P. HUNTINGTON, Architect D. RANDALL MACIVER, Librarian

The three buildings illustrated on this page form a group on upper Broadway and 156th Street. They were erected with funds given by Mr. Archer M. Huntington. Snead Standard Stacks are in use in the Hispanic Society and Geographical Society buildings.

Fig. 328

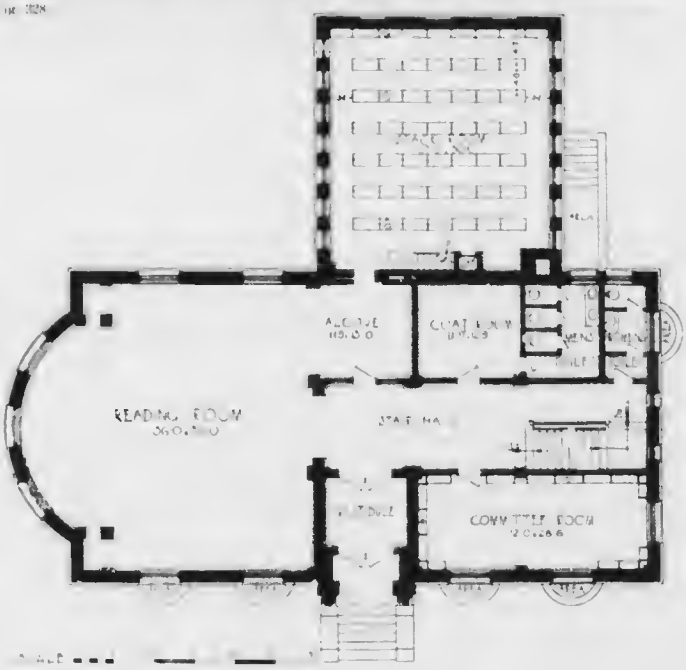


Fig. 329 FIRST FLOOR PLAN

RHODE ISLAND MEDICAL SOCIETY, PROVIDENCE, R. I.

CLARKE, HOWE & HOMER, Architects DR. GEO. D. HERSHEY, Librarian

A three-tier Snead Standard Stack has been installed in the stack room and Snead Standard wall shelving in the committee room on the first floor. Excepting the stack room, the entire second story is devoted to an assembly hall, while the basement contains a large lunch room and kitchen, book storage space and boiler room. An apartment of four rooms and bath, with entrance hall connecting directly with the street, is located in the basement, below the stack room.

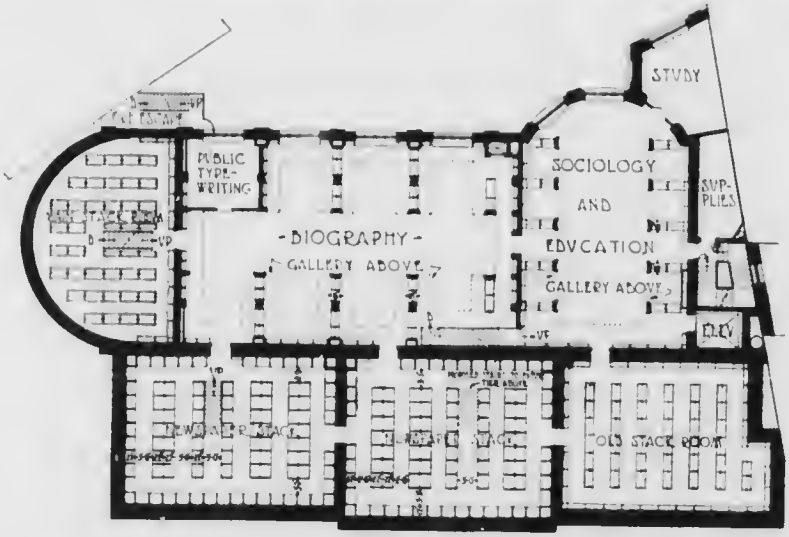


Fig. 330 THIRD FLOOR PLAN

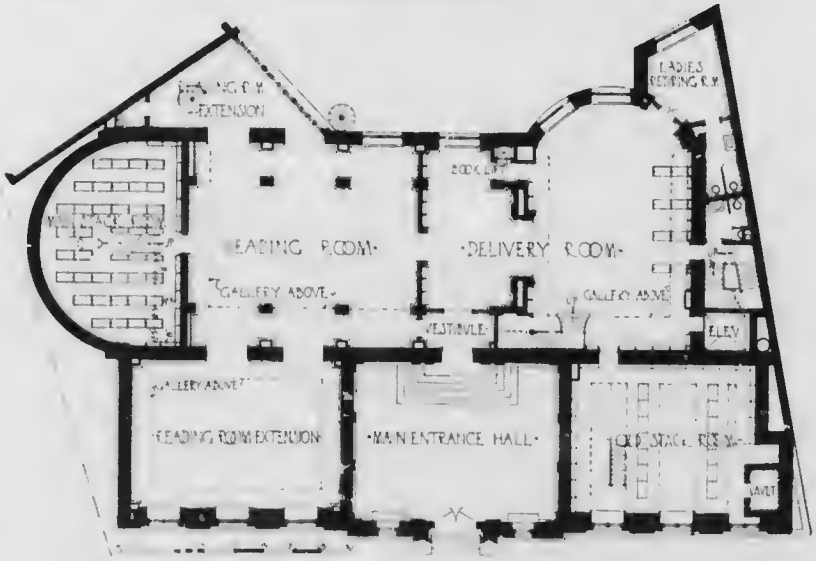


Fig. 331 FIRST FLOOR PLAN

BOSTON ATHENÆUM, BOSTON, MASS.

BIGELOW & WADSWORTH, Architects of remodeling CHAS. K. BOLTON, Librarian

In remodeling the building, the old alcove arrangement was retained but all wood stacks were replaced by metal Snead Standard Stacks. New fireproof floors and windows were constructed and all interior finish was made of noncombustible material. The architecture of the old building has been followed in this new work.

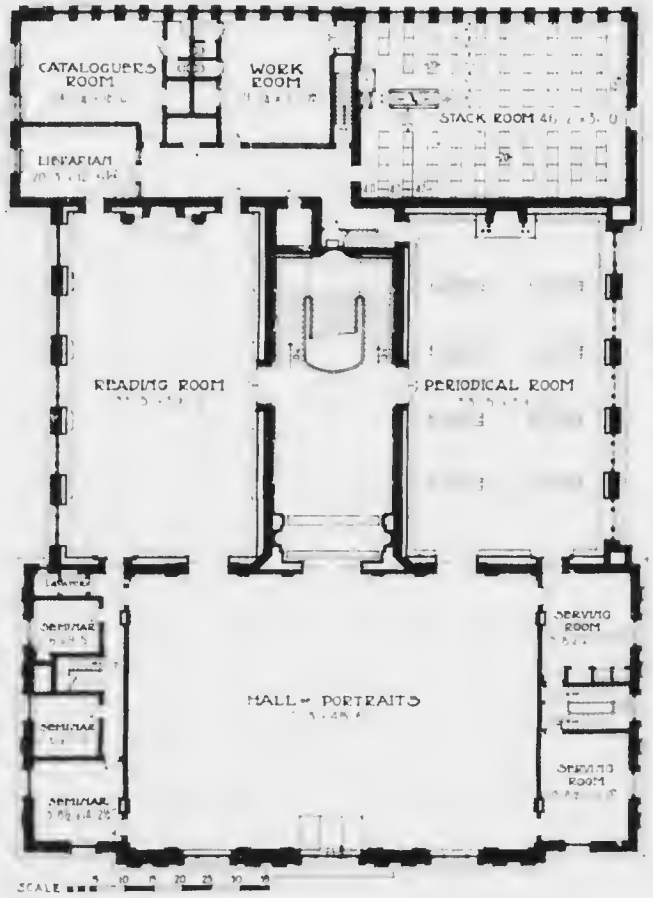


Fig. 182 SECOND FLOOR PLAN

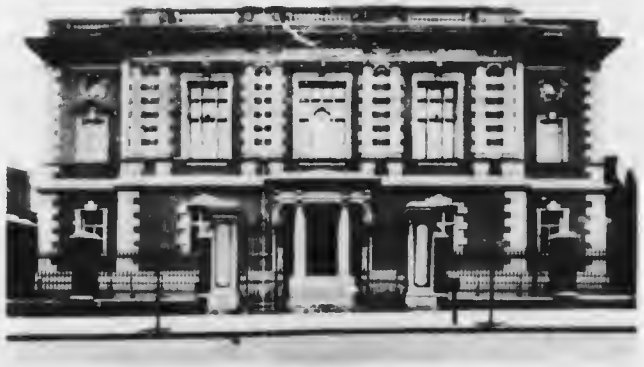


Fig. 181 ENTRANCE FRONT

PHILADELPHIA COLLEGE OF PHYSICIANS

Cope & Stewardson, Architects — Dr. Chas. Perry Fisher, Librarian

The six-tier stack room is thoroughly protected against fire either within the building or from neighboring structures. All the stack windows are fitted with wire glass set in metal sash and are protected by rolling steel shutters. These shutters, as well as the metal fire doors leading into the stack room, are held open by fusible metal links which open when subjected to excessive heat and allow the shutters and doors to close automatically. On the first floor, to the right of the vestibule, are the offices of the Nurses' Directory; to the left is the superintendent's office, beyond which, opening to the left, is the Hutchinson reception room. To the right and left of the main hallway are the Thomas and Cadwalader rooms, utilized by various scientific societies. The Gross library is also located on this floor. A large kitchen in the basement makes it possible to give the official dinners of the College in the building. The reading room and periodical room are named respectively the Ashhurst and Norris rooms, while the Hall of Portraits is known as Mitchell Hall.

Fig. 334. PHIPPS PSYCHIATRIC INSTITUTE, JOHNS HOPKINS HOSPITAL, BALTIMORE, MD.

GROSVENOR ATTERBURY, Architect — MISS EMILIE C. DUNBAR, Librarian

The library occupies an octagonal room on the second floor in the left hand bay shown in the illustration. The stack ranges stand between the windows and radiate toward a common center. Tables are placed between the ranges in front of the windows and also in the center of the room, the whole forming a compact and convenient combination stack and reference room. See illustration of interior, Fig. 53, page 13

Fig. 335. RUSSELL SAGE FOUNDATION BUILDING, NEW YORK CITY

GROSVENOR ATTERBURY, Architect — FREDERICK W. JENKINS, Librarian

The library occupies the entire eighth and eighth mezzanine floors and includes reading, catalog, reference, periodical, conference and work rooms, as well as a three-tier Snead Standard Stack. A loggia opening from the periodical room, faces on the street. A rest room, storage space and lunch room are provided on the mezzanine floor.

Fig. 336 FRONT VIEW

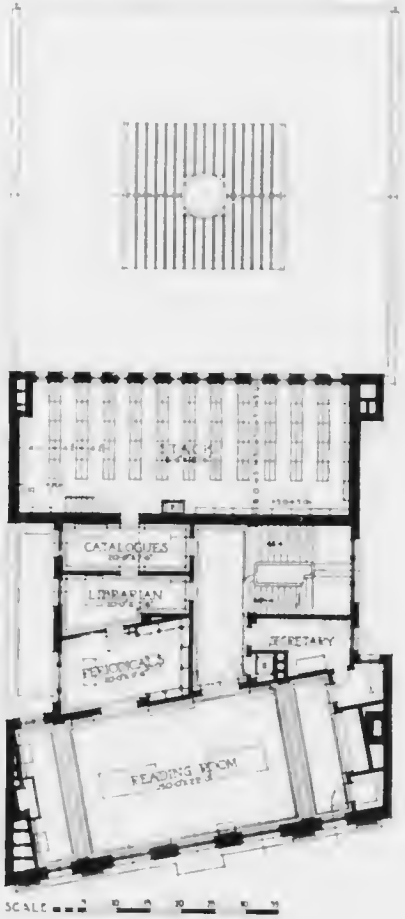


Fig. 337 SECOND FLOOR PLAN

MEDICAL AND CHIRURGICAL FACULTY OF MARYLAND, BALTIMORE, MD

ELLICOTT & EMMART, Architects

MISS MARTHA C. NOYES, Librarian

The stack room, with its first tier on the main floor of the building, contains two tiers of Snead Cast Iron Bracket Stack, with provision for the addition of three tiers above those in place. The small windows of the stack room are well protected to eliminate risk of fire from adjoining buildings. Two large lecture halls are located on the first floor, also a nurses' registry, reception room, section room, lavatory and coat room

OTHER SNEAD PRODUCTS

METAL AND GLASS MUSEUM CASES

STEEL STORAGE SHELVING

ARCHITECTURAL AND ORNAMENTAL IRON WORK

IRON CASTINGS

MACDONALD ROLLER RAMMING AND
PATTERN DRAWING MOLDING MACHINES

FOUNDRY EQUIPMENT

Fig. 438

MAIN ENTRANCE, BOSTON PUBLIC LIBRARY

McKim, Mead & White, Architects — Horace G. Wadlin, Librarian

The lamps and gates shown in the above illustration are examples of Snead wrought iron work. Special attention is given by Snead & Co. to carry out the spirit of architects' designs. The Snead Roller Ramming Moulding Machine equipment, developed for the manufacture of books-rack shelf supports, affords unequaled facilities for the production of fine iron castings for railings, screens, panels, facias and other architectural work. A special process of pattern making is employed in order to obtain true lines, fine mouldings, clean surfaces and a perfect match.

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Fig. 339. STEEL OFFICE SHELVING, CASSELLA COLOR COMPANY, NEW YORK CITY

This illustration shows the steel front of the storage space which occupies the end of an office. Double-faced steel shelving extends out from the far end wall so that each aisle opens directly into the room and is protected by a self-closing steel door with wire glass panel. To economize space, the partition has been made up of steel shelving opening into the room and protected by wire glass in metal frames. The work, finished in green baked enamel, is neat, compact, durable and incombustible.

Fig. 340. SNEAD STEEL SHELVING, N. Y. O. & W. RY. OFFICES, GRAND CENTRAL STATION, NEW YORK CITY

Uprights and shelves made of light cold rolled steel sheets. The edges of uprights are pressed into three-quarter inch round beads to secure the greatest strength and stiffness of the material. When backing plates are used, rear edges are flanged; when heavy loads are to be carried, the beads are reinforced with solid steel rods. Shelves, triple flanged along front and back edges, and single flanged on ends, are adjusted at any intervals by means of round headed bolts. Uprights and shelves act together so as to reinforce each other. This shelving, furnished in sizes as required, is of unit construction and therefore easily erected or taken down. Black or dark green baked enamel makes the most satisfactory finish.

Fig. 341. TYPE STORAGE CASES, AMERICAN TYPE FOUNDERS CO. JERSEY CITY, N. J.

The greatest possible saving in space has been accomplished by the use of solid cast iron uprights with shelving formed of sheet steel, rigidly flanged along the edges. The shelves are adjustable at intervals of about one inch and are readily interchanged. These ranges were designed to carry three tons of type in each two-foot compartment. The large shelf near the bottom permits of deep shelves for box cases below and forms a convenient step for reaching the upper rows of shelves. The construction is entirely incombustible, sanitary, and proof against wear and tear. Cases with cast iron uprights and steel shelves are made in sizes and designs to meet the special requirements of each installation.

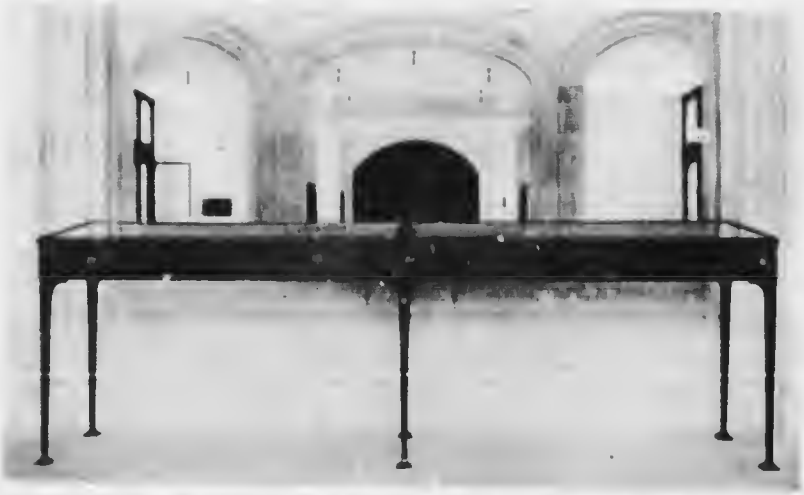

Fig. 312. SNEAD MEDICAL MUSEUM CASE, (Style M.1) McGILL UNIVERSITY, MONTREAL.
Sloping glass top case of metal construction. See also pages 82, 89 and 100. Upright cases of steel or bronze, with hinged or sliding doors and steel or glass adjustable shelves are also furnished, according to standard designs or to meet special requirements. Special attention is given to securing the maximum glass area, an attractive appearance, simple, durable construction and thorough protection from dust.

Fig. 313. SNEAD STEEL SHELVING, PUBLIC SCHOOL No. 108, BROOKLYN, N. Y.
The uprights are pressed into three-quarter inch beads along front and back edges to secure the requisite stiffness and to form a smooth surface of contact for the backs. The shelves are adjusted at any required interval by means of bolts passing through the webs of the uprights.

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